

CELULOZĂ ȘI HÂRTIE

VOL.59

NO. 2/2010

MANAGEMENT BOARD

G. Balogh, M. Botez, Eng. D. Buteică (Chairman), C-tin Chiriac (Vicechairman), P.H.Kohler, G. Crăciun, R. Crăciun, C. Ferrero, A. Itu, P.H. Kohler, Șt. Lupan, A. Oncioiu, A. Popovici, D. Tărășenie, A. Vais, V. Vasiliu

CUPRINS**CONTENTS**

MIRICA DEBELJAK, DIANA
GREGOR-SVETEC

MIRICA DEBELJAK, DIANA
GREGOR-SVETEC

Influența diferiților pigmenți utilizați la tipărirea hârtiei fără pastă mecanică prin procedeul de tipar offset asupra luminozității, cromaticii și luciului la tipărire

3

Influence of different effect pigments printed on wood-free paper in offset technique on lightness, chroma and print gloss

3

VIOREL IFTIMI, DAN GAVRILESCU

VIOREL IFTIMI, DAN GAVRILESCU

Implementarea managementului ciclului de viață al produselor și serviciilor în cadrul sistemului de management integrat al calității

9

Life cycle management products and services implementation in the integrated quality management system

9

CELLULOSE CHEMISTRY AND
TECHNOLOGY

CELLULOSE CHEMISTRY AND
TECHNOLOGY

Rezumatele lucrărilor publicate în vol.43 (2009)

16

Vol. 43(2009), Abstracts of published papers

16

Conferințe, Simpozioane

44

Conferences, Symposia

44

Quarterly journal edited by **THE TECHNICAL ASSOCIATION FOR ROMANIAN PULP AND PAPER INDUSTRY and**

PULP AND PAPER R&D INSTITUTE – SC CEPROHART SA – Brăila, Romania

Sponsored by **THE ROMANIAN OWNERSHIP OF PULP AND PAPER INDUSTRY**

ISSN: 1220 - 9848

EDITORIAL STAFF

Angels Pelach - University of Girona, Spain

Branka Lozo - Faculty of Graphic Arts, University of Zagreb, Croatia

Naceur Belgacem - INP- Pagora Grenoble, France

Ivo Valchev - University of Chemical Technology & Metallurgy, Sofia, Bulgaria

Elena Bobu - "Gheorghe Asachi" Technical University of Iași, Romania

Dan Gavrilescu - "Gheorghe Asachi" Technical University of Iași, Romania (*Editor*)

Paul Obrocea - "Gheorghe Asachi" Technical University of Iași, Romania

Valentin I. Popa - "Gheorghe Asachi" Technical University of Iași, Romania

Emanuel Poppel - "Gheorghe Asachi" Technical University of Iași, Romania

Teodor Măluțan - "Gheorghe Asachi" Technical University of Iași, Romania

Constantin Stanciu - "Dunărea de Jos" University of Galați, Romania

Petronela Nechita - Pulp and Paper Research and Development Institute - SC CEPROHART SA, Brăila, Romania (*Deputy Editor*)

Daniela Manea – Pulp and Paper Research and Development Institute - SC CEPROHART SA, Brăila, Romania

Eva Cristian – Pulp and Paper Research and Development Institute - SC CEPROHART SA, Brăila, Romania

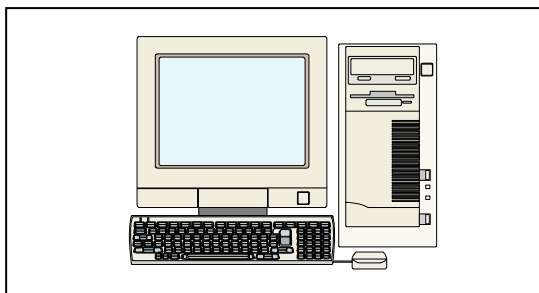
Nicoleta Gherghe – SC VRANCART SA Adjud, Romania

Mihai Banu - SC AMBRO SA, Suceava, Romania

The foreign readers may subscribe by TECHNICAL ASSOCIATION FOR ROMANIAN PULP AND PAPER INDUSTRY, (ATICHR), Walter Mărăcineanu Square no.1-3, Entry 2, Fl. 2, Room 177-178, Land 1, Bucharest, RO-78101, phone: + 40 21 315 01 62, + 40 21 315 01 75, Fax: +40 21 315 00 27, E-mail: rompap@pcnet.ro ; rompap@msn.com

The articles, information, advertising can be sent on "CELULOZĂ ȘI HÂRTIE" editorial office address: Al.I.Cuza Blvd, no.3, 810019, Brăila, Romania, phone: +40 239 619 741, fax: +40 239 680 280, e-mail: petronela.nechita@ceprohart.ro, or Walter Mărăcineanu Square, no. 1-3, land 1, Bucharest, phone: + 40 21 315 01 62, + 40 21 315 01 75

Aknowledged in Romania, in the Polymer Materials Sciences field, by the National Council of the Scientific Research from the Higher Education (CNCSIS), C group. Indexed in PaperBase Abstracts, PIRA International (www.paperbase.org, www.piragnet.com)



Printed by OFFSET GRAFIC SERV Srl, Brăila,
Phone: +40 239 618 206

INFLUENCE OF DIFFERENT EFFECT PIGMENTS PRINTED ON WOOD-FREE PAPER IN OFFSET TECHNIQUE ON LIGHTNESS, CHROMA AND PRINT GLOSS

Mirica Debeljak^{*)}, Diana Gregor-Svetec^{*)}

^{*)}University of Ljubljana, Faculty of Natural Sciences and Engineering, Slovenia

Author correspondence: University of Ljubljana, Faculty of Natural Sciences and Engineering, Slovenia, e-mail: mirica.debeljak@ntf.uni-lj.si

Abstract

The aim of research was to investigate the influence of different effect pigments printed on wood-free paper in offset technique on lightness, chroma and print gloss. Three different effect pigments were used: pigment Biflair, pigment Iriodin 119, and interference pigment Iriodin 231. Pigment Biflair is based on Bismuth Oxychloride (BiOCL) crystals, while pigments Iriodin 119 and Iriodin 231 are based on mica. Effect pigments were overprinted on dried CMYK offset prints. According to the results, all three effect pigments contributed to the increase of print gloss. Pigment Biflair resulted in the highest print gloss, especially on yellow offset print. The pigment type has also influence on lightness and chroma. At observation angle of 15° overprinted CMYK inks by all pigments were the lightest, while at angle of 110° were more dark. Influence of multi-angle measurement on chroma indicated the highest impact at angle of observation of 75° and 110°, and the smallest at angle of 15°. Interference pigment Iriodin 231 has the smallest impact on lightness and the highest on chroma, while silver-white Biflair the highest on lightness and the smallest on chroma.

Key words: *Offset prints, Effect pigments, Print gloss, Wood-Free Paper, Multi-angle Measurement, SEM Analysis*

Rezumat

Scopul cercetării a fost de a investiga influența diferiților pigmenți utilizați la tipărirea hârtiei fără conținut de pastă mecanică prin procedeul offset, asupra luminozității, cromaticii imaginii tipărite și a luciului la tipărire. Au fost utilizate trei tipuri de pigmenți: Biflair, Iriodin 119 și un pigment pentru interferență Iriodin 231. Pigmentul Bisflair este pe bază de cristale de oxiclură de bismuth (BiOCl), în timp de pigmenții Iriodin 119 și Iriodin 231 sunt pe bază de mică. Efectul pigmenților a fost urmărit prin reimprimare pe tipărituri offset cu cerneluri CMYK. În concordanță cu rezultatele obținute, toate cele trei tipuri de pigmenți au contribuit la creșterea luciului la tipărire. Pigmentul Biflair a avut ca rezultat obținerea celui mai ridicat luciu la tipărire, în special pe tipăriturile offset de culoare galbenă. Acest tip de pigment are influență și asupra luminozității și cromaticii imaginii tipărite. Măsurătorile sub unghi de 15° ale pigmenților reimprimați pe tipăriturile offset cu cerneluri CMYK au scos în evidență cele mai deschise nuanțe, în timp ce sub unghi de 110° nuanțele au fost mai închise. Influența măsurătorilor efectuate sub mai multe unghiuri asupra parametrului cromatic au indicat cel mai mare impact la unghiul de observare de 75° și 110°, iar cel mai redus efect la unghiul de 15°. Interferența pigmentului Iriodin 231 a avut cel mai redus impact asupra luminozității și cel mai mare asupra cromaticii, în timp de pigmentul Biflair, alb – argintiu a avut cel mai mare impact asupra luminozității și un efect mai redus supra caracteristicilor cromatice..

Cuvinte cheie: *Tipărituri offset, Efectul pigmenților, Luciu la tipărire, Hârtie fără pastă mecanică, Măsurători multiunghiulare, Analize SEM*

INTRODUCTION

The range of application media for effect pigments includes paint, coating, plastics, printing inks, construction materials, ceramic products, glass, enamel, and cosmetic formulations.

Pigments are differentiated and classified with respect to the way in which they interact with light. One of them are effect pigments, which are classified as *metal effect pigments* or *pearl luster pigments*. Effect pigments are colorants that give additional color effects, such as angular color dependence (iridescence, color travel, luster) or texture, when applied in an application medium. The most important effect pigments without a layer structure are by far the metal effect pigments.

They consist of flakes or lamellae of aluminum (aluminum bronzes), copper and copper-zinc alloys (gold bronzes). Very thin metallic flakes act as miniature mirrors. Their intensity changes according to the angle from which they are viewed. Maximum light intensity is achieved near the "gloss", at the angle at which the incident light is reflected. Minimum is experienced at an angle far away from the gloss. In applications, with a parallel aligned orientation in their application system, they show a metal-like luster by reflection of light at the surface of the metal platelets. The required particle size of the pigments depends on the intended use and can vary from few micrometers (offset printing) to medium grades (10-45 μ m).[1-3]

Luster pigments tend to be composed of predominantly platelet-like particles, that readily align with a parallel orientation to the surface to which they are applied. This leads to a characteristic luster arising from the reflection of incident light from the smooth surface of the pigment platelets. Pearl luster pigments on the other hand are luster pigments consisting of transparent or semitransparent platelets of metal oxides or other materials with high refractive index. They can also be applied with a parallel orientation to give a characteristic pearl luster generated by multiple reflections. Pearl luster pigments showing additional colors generated by interference of light are also designed as nacreous or interference pigments. Interference pigments are by definition effect pigments whose color is generated completely or predominantly by the phenomenon of interference of light. [1]

Interference pigments may be classified by either the method employed for their manufacture or their structure. Substances, such as titanium dioxide or iron oxide, that have high indices of refraction, may, for example, be

deposited on a transparent substrate, such as mica, as in the case of Iriodin. Interference pigments manipulate incident light by means of refractions and reflections such that the resultant refracted and reflected light generates color perceptions in the human eye and brain.

Effect pigments can be used in various printing techniques, including offset printing.^{4,5} The new generation of effect pigments requires a totally different system of measurement and characterization. Due to its chemical constitution and physical properties, every single pigment particle behaves like an interference filter. It separates incident light into a reflected portion of one color and a portion of transmitted light with a complimentary color. The important interference property connected to this is the color change at different angles of view. The colorimetric analysis of effect pigments also varies with the angle of measurement. Effect pigments can evaluate by three completely differing measuring principles: fixed illumination angle of 45°/0° with variable observation angles (we used this method in our research), fixed observation angle of 45°/0° with variable illumination angles or variable illumination and observation angles. [1-3]

EXPERIMENTAL

Methodology

In this study, three different effect pigments were used: pigment *Biflair* (silver-white), pigment *Iriodin 119* (silver-white), and interference pigment *Iriodin 231* (fine green). Iriodin® is the trademark for a very special type of pigments from the Merck company. Effect pigments were overprinted on dried CMYK offset prints on wood-free paper (G-print, Stora Enso, Finland). Paper consist of 100% virgin fibre and it's coated. The paper was printed in offset technique (KBA Performa 74) in the following sequences: first offset inks (SunChemical), after 24 hours were overprinted effect pigments, which were mixed in oil-based varnish (TopFinish TPF99). A printing test form was prepared with CMYK solid colors.

Measurements

Microscopic analysis of pigments particles were made by Scanning Electron Microscope JOEL JSM-6060 at 1000 x magnification and 10 kV voltage. The print gloss was measured at 60° using GlossMaster manufactured for quality imaging products. Measurements conform to the ASTM D523

standard measurement protocol. Overprinted pigments on CMYK prints were measured by X-Rite MA68II multi-angle spectrophotometer. The X-Rite MA68II spectrophotometer illuminates the surface from an angle of 45° and offers viewing angles of 15°, 25°, 45°, 75° and 110°.

RESULTS AND DISCUSSION

SEM analysis

The use of scanning electron microscopy (SEM) for effect pigments is not complicated since these samples do not charge under vacuum and most of the interesting features are accessible via this technique. [2] SEM images of effect pigment particles Biflair, Iriodin 119 and Iriodin 231 are presented in Figures 1-3.

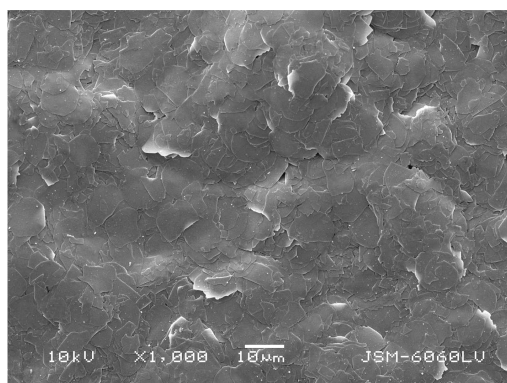


Fig. 1 SEM image of effect pigment Biflair at 1000x magnification

Biflair is made from synthetically produced Bismuth Oxychloride (BiOCl) crystals. Bismuth oxychloride was the first synthetic non-toxic pearl luster pigment that existed. It is precipitated by hydrolysis of acidic salt solutions in the presence of chloride ions. Biflair pigments create bright highlights interchanging with deep and saturated color effects; offering a high degree of opacity and whiteness with a cool bluish cast.

This brilliant luster effect is created by light interference in the crystal structure. They are especially appropriate for use in printing processes. From the Figure 1 is seen that pigments are connected together. The reason for this is in pigment preparation. The effect pigment Biflair has symmetrical octagon shape, transparency and narrow particle size distribution. Pigment particles suitable for such effects exhibit a narrow distribution of diameter especially in the range 7 to 14 µm. [1, 5]

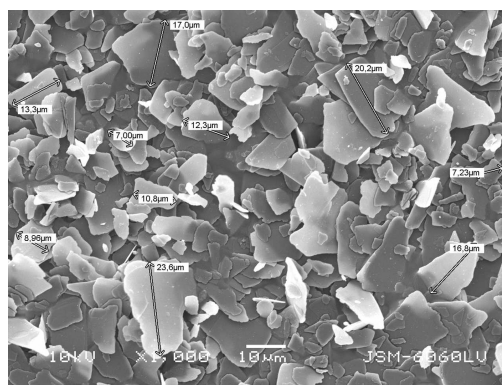


Fig. 2 SEM image of pigment Iriodin 119 at 1000x magnification

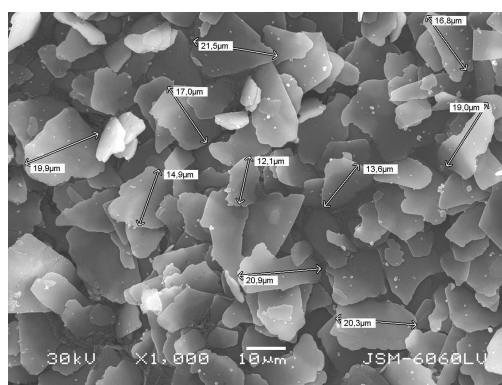


Fig.3 SEM image of interference pigment Iriodin 231 at 1000x magnification

Pigment Iriodin 119 and Iriodin 231 are based on natural mica. In the case of Iriodin pigments (Figures 2-3) the individual particles, that are separated are clearly seen. Both pigments have approximately the same size of particles (7-23 µm). For offset printing are recommended pigments particles with size 5-25 µm. Effects created with Iriodin depend on the pigment type and the pigment particle size. Glittery or silky matte luster effects are created by varying the pigment particle size. When the thickness of the metal oxide on the mica layer is increased minutely pearl luster pigments emit a colored shine due to the physical phenomenon of the interference of light waves. These are called interference pigments, which allow an iridescent color effect. [2,5]

Print gloss

In the first stage of the investigation, the print gloss of offset prints and also overprinted different effect pigments on them were analyzed. The measured values are presented in Figure 4.

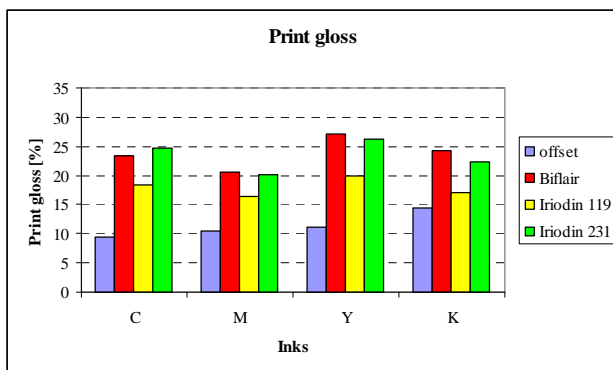


Fig. 4 Print gloss of offset prints and overprinted effect pigments

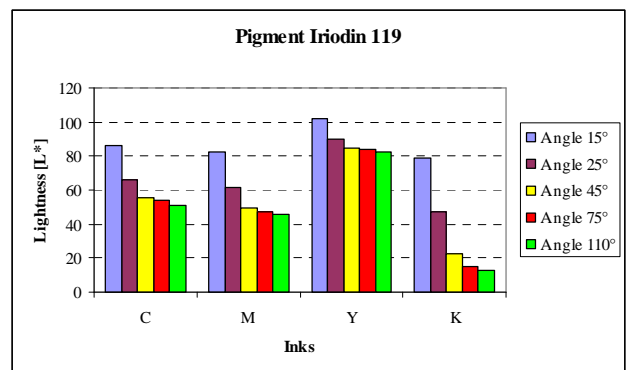


Fig. 6 Influence of multi-angle measurement on lightness of pigment Iriodin 119

Gloss is a characteristic of the surface of a printing substrate. It's the light reflected from the surface, whereby the angle of incidence of the light is the same as the angle of the greater part of reflection. The gloss characteristics of coated papers influence the gloss of the inks that are applied to them. Gloss can increase also after printing by applying an overprint varnish or lamination and is also influenced by effect pigments. The paper itself and the ink itself have effect on the gloss. [6-8] It can be seen from the Figure 4 that black offset ink obtained the highest print gloss (14.43%). It was found that effect pigments have effect on the print gloss. Considerable changes in the gloss have appeared on all overprinted CMYK prints. All effect pigment contributed to the increase of print gloss. The highest gloss was obtained by the pigment Biflair, while by pigment Iriodin 119 the smallest.

Influence of multi-angle measurement on pigment lightness

In figures 5-7, the influence of multi-angle measurements on pigment lightness is presented.

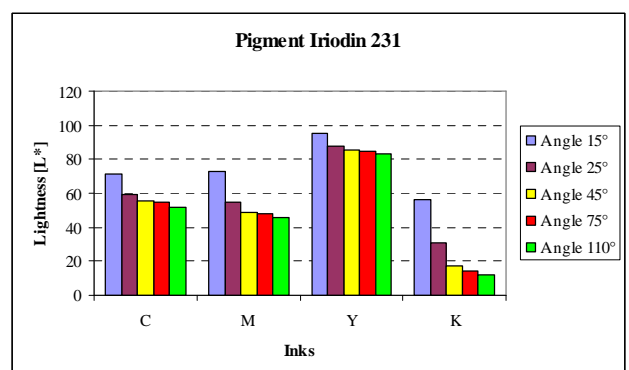


Fig. 7 Influence of multi-angle measurement on lightness of interference pigment Iriodin 231

For effect pigments, angle-dependent spectrophotometric testing is a necessity. Measurements are made at 15°, 25°, 45°, 75° and 110°. As can be seen from Figures 5-7, the lightness of overprinted pigments varies with the measurement at different angles. All overprinted CMYK prints measured at angle 15° are the lightest, while at angle 110° are more dark. It was established that lightness at all three pigments from angle 15° to angle 110° exponential decreased. The pigment type has also influence on lightness. On average green interference pigment Iriodin 231 has the smallest impact on lightness, while silver-white Biflair the highest. In the case of overprinted pigment Biflair on cyan print measured at 15°, the lightness value was L*=90.14, at pigment Iriodin 119 L*=85.96 and at the pigment Iriodin 231 L*=71.62. The most obvious decrease in lightness was obtained at black print (values from 15° to 110° at pigment Biflair dropped for 71.32, at Iriodin 119 dopped for 65.97, and at Iriodin 231 for 44.26) and the smallest at yellow print (at Biflair values dopped for 25.05, at Iriodin 119 dopped for 19.92, and at Iriodin 231 for 12.39).

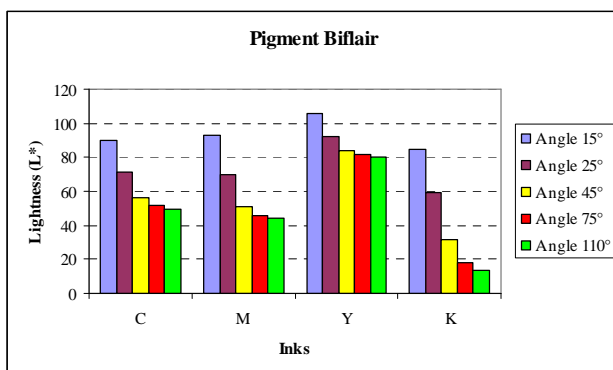


Fig.5 Influence of multi-angle measurement on lightness of pigment Biflair.

Influence of multi-angle measurement on pigment chroma

A color's purity describe its chromaticity or chroma. This property of color tell us how pure a hue is. That means there is no white, black, or grey present in a color that has high chroma. [9] The influence of multi-angles measurement on chroma of overprinted pigments are presented in Figures 8-10.

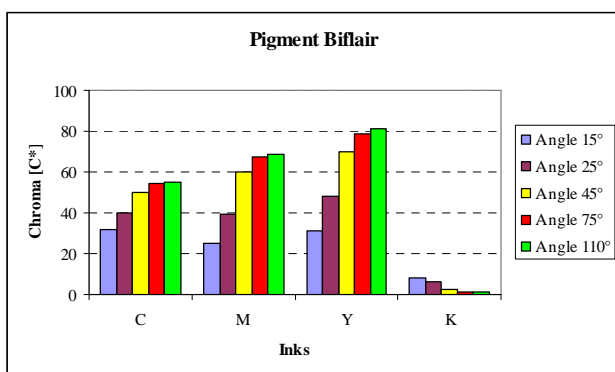


Fig. 8 Influence of multi-angle measurement on chroma of pigment Biflair.

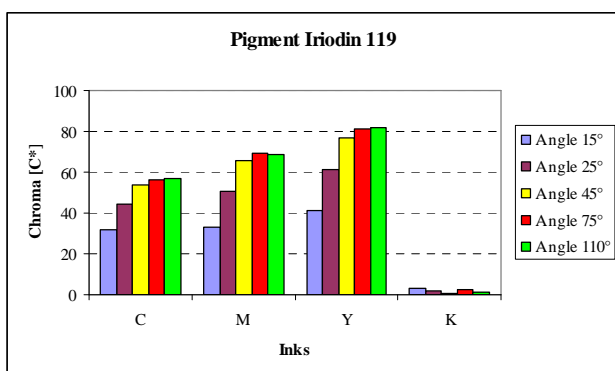


Fig. 9 Influence of multi-angle measurement on chroma of pigment Iriodin 119

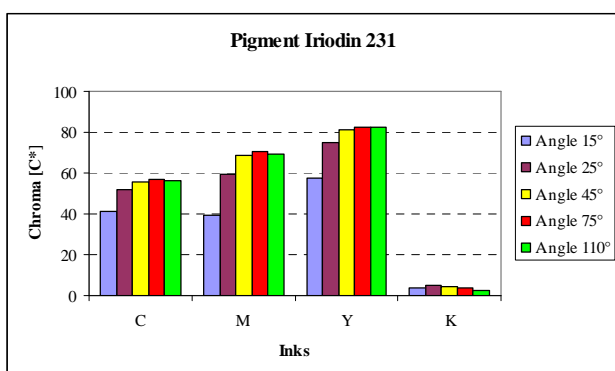


Fig. 10 Influence of multi-angle measurement on chroma of interference pigment Iriodin 231

Figures 8-10 show significant discrepancies of chroma measured at different angles. It was noticed that at cyan, magenta and

yellow offset prints all three overprinted pigments (Biflair, Iriodin 119, and Iriodin 231) contribute to linear increase of chroma. Chroma of overprinted pigment Biflair on black ink decreased, of pigment Iriodin 119 increased at 75° and then decreased, and of pigment Iriodin 231 increased at 25° and 45° and after that decreased. The results indicated that pigment Biflair has the smallest impact on chroma, while interference pigment Iriodin 231 the highest. Values of chroma measured from 15° to 110° increased at overprinted pigment Biflair on cyan for 23.51, on magenta for 43.33, on yellow for 49.63, and decreased on black offset print for 6.76 (Figure 8). In the case of overprinted pigment Iriodin 119 values increased on cyan for 24.55, on magenta for 35.79, on yellow for 40.63 and on black print decrease for 1.39 (Figure 9). The results obtained at overprinted interference pigment Iriodin 231 show increase of chroma for 15.19 at cyan, for 29.87 at magenta, for 25.18 at yellow and decrease for 1.43 at black print (Figure 10).

CONCLUSIONS

In this study the characterization of overprinted effect pigments on dried offset prints were studied. Pigment based on bismuth oxychloride (BiOCL) has different influence on print gloss compared to those based of natural mica (Iriodin). Higher print gloss was obtained at overprinted pigment Biflair. Comparing results from different multi-angle measurement show that at angle 15° all three pigment printed on CMYK offset inks are darker, while with increasing of measurement angle to 110°, the overprinted pigments became more bright. Significant differences in chroma were also noticed. On cyan, magenta and yellow offset prints all three overprinted pigments (Biflair, Iriodin 119, and Iriodin 231) contribute to increase of chroma, while on black print decrease. SEM analysis show that pigment Biflair has narrow particle size distribution and from both Iriodin pigments individual particles, that are separated are clearly seen.

ACKNOWLEDGEMENTS

Financial support from the Slovenia Research Agency is gratefully acknowledged.

REFERENCES

1. Pfaff G.: *Special effect pigments: technical basis and applications*, Hannover: Vincentz Network, 2008, p. 16-17, 36-39, 197-204.
2. Maile F. J., Pfaff G., Reynders P.: *Effect pigment – past, present and future* - Progress in Organic Coatings, vol. 54, 2005, pp. 151-163.
3. "Measuring special effects", accessed April 2010
http://www.pcimag.com/Articles/Feature_Article/1f1697a0a66a7010VgnVCM100000f932a8c0
4. "Description and Characterization of Interference pigments", accessed April 2010
http://www.ua.es/area/vision_color/docs/cramer/cramer5.pdf
5. *Effect pigments for the printing industry*; Merck KGaA, Printing Industries, Germany
6. Kipphan H., *Handbook of print media : Technologies and Production Methods*, Springer, 2001, p. 110-111, 136-137.
7. Romano Frank J., *Professional, Prepress, Printing, and Publishing*, Upper Saddle River: Prentice Hall, 1999, pp. 153-154.
8. "Paper, Ink and Press Chemistry", accessed April 2010
<http://www.sappi.com/NR/rdonlyres/04D29883-FC5C-450D-BC639401B62D91A6/0/PaperInkandPressChemistry.pdf>
9. "Color Glossary", accessed Apr 2010
<http://www.colorcube.com/articles/theory/glossary.htm>

IMPLEMENTAREA MANAGEMENTULUI CICLULUI DE VIAȚĂ AL PRODUSELOR ȘI SERVICIILOR ÎN CADRUL SISTEMULUI DE MANAGEMENT INTEGRAT AL CALITĂȚII

Viorel Iftimi^{*)}, Dan Gavrilăscu^{**)}

^{*)}S.C. ISO PROJECT Suceava

^{**)}Universitatea Tehnică „Gheorghe Asachi” din Iași

Correspondența autor: ^{*)}S.C. ISO PROJECT Suceava, e-mail: viirel_iftimi@yahoo.com,
tel. 0728 166 131

Rezumat

Scopul acestei lucrări este de a dezvolta Sistemele de Management Integrat prin implementarea, într-o întreprindere mică sau mijlocie, a Managementului Ciclului de Viață al produselor și serviciilor (LCA) în cadrul unui Sistem de Management deja existent, Calitate – Mediu – SSM.

Prima parte cuprinde o scurtă sinteză a datelor din literatura de specialitate privind principiile și etapele implementării unui Sistem de Management Integrat într-o organizație.

În partea a doua a acestui articol se propune corelarea cerințelor standardelor de referință seria SR EN ISO 14040 referitoare la Managementul LCA cu cerințele Standardului SR EN ISO 9001 – Sistemul de Management de Calitate.

Key words: Management Systems, Life Cycle Assessment, Standards

Abstract

The aim of this paper is to develop integrated management systems by implementing, within a SME, the lifecycle management of products and services (LCA) under a Management System, already existing Quality – Environment – OSH. The first part of the paper contains a brief summary of the data in the literature on the principles and steps to implement an Integrated Management System in an organization. In the second part of this paper, we propose matching requirements of reference standards EN ISO 14040 series on LCA Management with SR EN ISO 9001 – Quality Management System

Cuvinte cheie: Sisteme de Management, Evaluarea Ciclului de Viață, Standarde

INTRODUCERE

În mod obișnuit, prin Sistem de Management Integrat se înțelege implementarea standardelor de referință de Calitate, Mediu și Sănătate și Securitate Ocupațională, finalizată cu Certificarea de către un Organism de Certificare recunoscut și acreditat.

J. M. Juran a postulat trilogia sa: *Planificarea, Controlul și Îmbunătățirea Calității produselor și proceselor* - dusă mai departe de Juran Institute - care insistă asupra implementării

efective (eficient și eficace) a acestor standarde, fără a pune accent pe Certificare.

Obiectivul nostru este implementarea acestor Sisteme Integrate în firme mici și mijlocii.

Mai întâi s-a implementat standardul de referință *SR EN ISO 9001:2008*. Acesta introduce ordine și predictibilitate în managementul Organizației/ Firmei. Standardul impune stabilirea clară a proceselor sistemului, stabilirea unor obiective clare (prin politică) și dezvoltarea de proceduri pentru procesele determinate. Obligatoriu, se stabilesc regulile pentru controlul

documentelor și al înregistrărilor, politica și angajamentul managementului, poziția pe piață, controlul resurselor umane, materiale și de autoritate, controlul realizării produsului/serviciului cât și modalitățile de monitorizare a produselor/ serviciilor neconforme cu auditarea proceselor și analiza de management. Certificarea Sistemului urmărește regula celor 3D: *Documentează* (existența documentației), *Describe* (documentația este cunoscută și implementată), *Demonstrează* (cum acționăm practic + înregistrările). Se urmărește implementarea ciclului P-D-C-A (Planifică - Efectuează - Verifică - Acționează) și capacitatea de îmbunătățire continuă a Sistemului.

Implementarea referențialului SR EN ISO 14001:2005 pentru Managementul de Mediu a fost impusă din două direcții convergente: eficiența (privită ca pierderi de energie și materiale) și poluarea ca impact asupra mediului și părților interesate (penalități, imagine, avize de funcționare). [1] Referențialul cuprinde cerințele principale ale standardului ISO 9001 și aduce în plus - minimal - *Identificarea aspectelor de mediu și evaluarea impacturilor asupra mediului, Pregătire pentru situații de urgență și capacitate de răspuns și Gestionarea și depozitarea deșeurilor.*

Implementarea referențialului SR OHSAS 18001:2007 pentru Managementul Sănătății și Securității Ocupaționale a fost impusă ulterior și vizează două direcții: SSM (Sănătate și Securitate în Muncă) și SSO (Sănătate și Securitate Ocupațională), având abordări și nuanțe specifice. Și acest referențial cuprinde cerințele principale ale standardului ISO 9001 și aduce în plus - tot minimal - *Identificarea pericolelor, evaluarea și controlul riscurilor, Pregătirea situațiilor de urgență și capacitate de răspuns în abordare SSM.*

O modalitate de integrare a ultimelor două referențiale este implementarea lor având ca punct de plecare clauza 6.4.4 - Mediu de lucru.

LCA - Evaluarea Ciclului de Viață (Life Cycle Assessment), așa cum arată însuși standardul *SR EN ISO 14040*, „este o tehnică pentru evaluarea aspectelor de mediu și a impacturilor potențiale asociate unui produs, prin:

- realizarea unui inventar pentru elementele relevante de intrare și ieșire ale unui sistem-produs;
- evaluarea impacturilor potențiale de mediu asociate acelor intrări și ieșiri;
- interpretarea rezultatelor analizei inventarului și a fazelor de evaluare a impacturilor, în relație cu obiectivele studiate.

LCA studiază aspectele de mediu și impacturile potențiale pe durata ciclului de viață

al produsului (de exemplu „cradle-to-grave”), de la achiziția materiilor prime, continuând cu producția, utilizarea și post-utilizarea. Categoriile generale ale impacturilor de mediu, care sunt necesare să fie luate în considerare, includ utilizarea resurselor, sănătatea umană și consecințele ecologice.”[2]

Observăm că LCA introduce conceptul “sistem-produs” și analizează un flux ce cuprinde mai multe procese care, practic, sunt mai multe firme mici/mijlocii cu Sisteme de Management Integrate proprii. Pentru exemplificare, în figura 1, prezentăm un flux de transport al merelor ambalate în cutii de carton ondulat. [3]

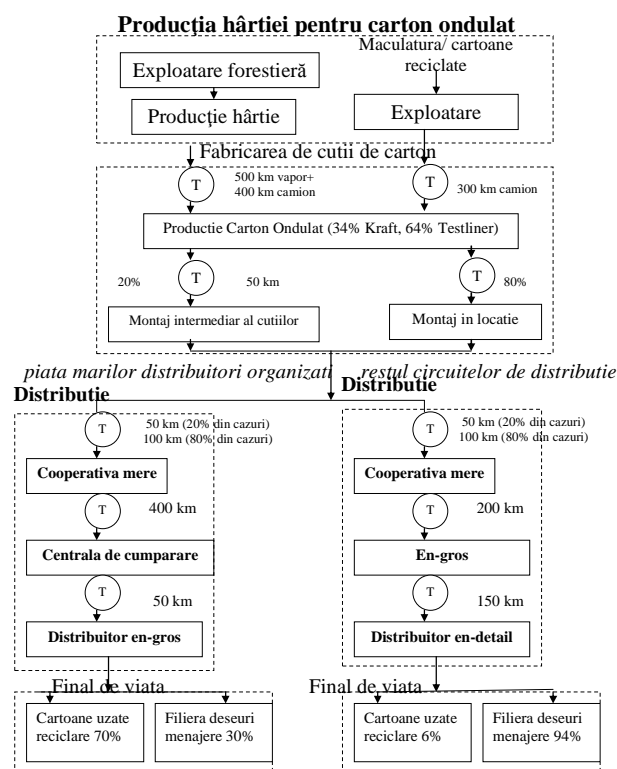


Fig. 1 Fazele procesului de transport al unor produse

Aceste concepte și standarde internaționale sunt integral asimilate și implementate în Uniunea Europeană (EN) și implicit pe plan național (SR). Pe piața românească a certificărilor acționează toate marile Organisme de Certificare interconectate prin acreditări reciproce.

1. PRINCIPIILE ȘI ETAPELE DE IMPLEMENTARE A UNUI SISTEM DE MANAGEMENT

Plecăm de la premiza că firmele au deja implementat un Sistem Integrat și doresc

extinderea domeniului de certificare, moment în care vor trebui să demonstreze că documentația revizuită, respectă cerințele standardelor.

1.1 Prezentare generală a Sistemului de Management Integrat al Calității, SMM, SSM

Sistemul de Management Integrat cuprinde implementarea cerințelor standardelor de Management al Calității, Mediului și al Sănătății și Securității Ocupaționale.

În mod frecvent, implementarea Sistemului se face pe scheletul standardului SR EN ISO 9001:2008 plecând de la premiza că acesta a fost primul sistem implementat (de minim 3 ani), și având deja documentate și implementate procedurile de sistem, care sunt impuse și de celelalte standarde, în clauze echivalente, după cum sunt prezentate în tabelul 1.

Tabelul 1 Procedurile obligatorii corelate cu clauzele standardelor referențiale

Procedura	Clauzele din ISO		
	9001	14001	18001
PS 4.2.3 Controlul documentelor	4.2.3	4.4.5	4.4.5
PS 4.2.4 Controlul înregistrărilor	4.2.4	4.5.4	4.5.4
PS 8.2.2 Audit intern	8.2.2	4.5.5	4.5.5
PS 8.3 Controlul produsului neconform	8.3	4.4.7	4.4.7
PS 8.5.2 Acțiune corectivă	8.5.2	4.5.3	4.5.3.2
PS 8.5.3 Acțiune preventivă	8.5.3		
PO 5.6 Analiza efectuată de management	5.6	4.6	4.6
PO 6.2.2 Competență, instruire și conștientizare	6.2.2	4.4.2	4.4.2
PO-7.2 Procese referitoare la relația cu clientul	7.2	4.4.6	4.4.6
PO-7.3 Proiectare	7.3		
PO-7.4 Aprovizionare	7.4		
PO-7.5 Producție și furnizare de servicii	7.5		
PO 7.6 Controlul dispozitivelor de măsurare și monitorizare	7.6	4.5.1	4.5.1

Ac acestea sunt Procedurile de Sistem obligatorii cerute de clauzele celor trei standarde referențiale. Reamintim că la orice audit de certificare se solicită, obligatoriu, rapoartele ultimelor audituri interne și raportul ultimei analize de management.

Implementarea cerințelor standardelor de Management al Mediului și Sănătății și Securității Ocupaționale impun o serie de Proceduri obligatorii conform tabelului 2.

Tabelul 2 Procedurile introduse suplimentar de standardele referențiale 14001 și 18001

Procedura	Clauzele din ISO		
	9001	14001	18001
PS-4.3.1 Identificarea aspectelor de mediu și evaluarea impacturilor asupra mediului	5.2 7.2.1	4.3.1	4.3.1
PO 5.5.3 Comunicare internă	5.5.3	4.4.3	4.4.3
PO 4.4.7 Pregătire pentru situații de urgență și capacitate de răspuns	8.3	4.4.7	4.4.7
PO-6.4-1 Identificarea pericolelor, evaluarea și controlul riscurilor	5.2 7.2.1	4.3.1	4.3.1
PS-4.4.6 Gestionarea și depozitarea deșeurilor	7.5	4.4.6 4.3.2	4.4.6 4.3.2
PO 4.3.2 Cerințe legale și alte cerințe	5.2		

Ac aceste Proceduri de Sistem sunt specifice standardelor referențiale ISO 14001 și ISO 18001 și este o schemă minimală la care se pot adăuga formulare, instrucțiuni de lucru sau proceduri operaționale, funcție și de specificul activității Organizației. Procesul demarează cu stabilirea proceselor pe formularul *F-4.1-1 Harta proceselor SMI* și de aici se stabilesc Procedurile și înregistrările necesare. Autorii articolului vă stau la dispoziție cu sfaturile necesare rezultate din experiența implementărilor a peste 70 de Sisteme și certificării cu peste 7 Organisme de Certificare cu recunoaștere internațională.

1.2 Standardele LCA - Evaluarea Ciclului de Viață

Conceptele „verzi” au adus o nouă serie de standarde seria *SR EN ISO 14040 Management de mediu Evaluarea Ciclului de Viață Principii și cadru de lucru* (Life Cycle Assessment) sau prescurtat **LCA**.

Ac aceste standarde promovează o nouă filozofie a produsului gândit și proiectat de la început, ținând seama de consumul de materii prime, fabricație și ciclul său de viață până la finalul vieții (preferabil prin reciclare). [4]

Ansamblul proceselor cuprinde *definirea scopului, domeniului de aplicare și analiza de inventar, evaluarea impactului ciclului de viață, interpretarea ciclului de viață*, totul pe un *format al documentației* referitoare la date cu format stabilit.

Dat fiind caracterul pronunțat tehnic al acestor standarde au apărut diverse soft-ware-uri ajutătoare.

SR EN ISO 14040 Principii și cadru de lucru statuează cadrul evaluării ciclului de viață:

- în Clauza 4.1 - *Caracteristici cheie ale LCA* se stipulează că „Nu există o metodă unică pentru conducerea studiilor LCA. Organizațiile ar trebui să aibă flexibilitate pentru a implementa practic LCA așa cum este stipulat în acest Standard Internațional, pe baza aplicației specifice și cerințelor utilizatorului”. Prin aceasta, se postulează faptul că nu există Sisteme sau soluții software universale – fiecare Sistem este unic, are specificitatea sa, dar trebuie să respecte cerințele referențialului.
- în Clauza 4.2 *Fazele unui studiu LCA* sunt prezentate fazele principale ale LCA conform figurii 2. [5]

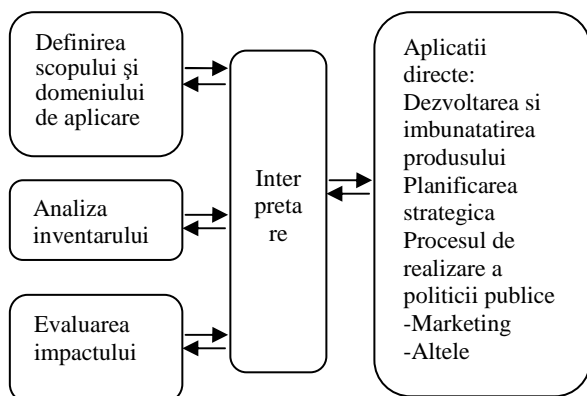


Fig. 2 Fazele LCA

În continuare se stabilește Cadrul metodologic general, Raportarea și modul de efectuare a Analizei critice.

SR EN ISO 14041 Definirea scopului, domeniului de aplicare și analiza de inventar detaliază etapele, modul de lucru și structura rapoartelor elaborate. Trebuie aplicate toate prevederile standardului. Prin acesta se introduce conceptul de „sistem-produs”.

SR EN ISO 14042 Evaluarea impactului ciclului de viață – LCIA – este etapa a 3-a din procesul de evaluare a LCA și are drept scop evaluarea rezultatelor analizei inventarului ciclului de viață (LCI) ale unui sistem-produs.

SR EN ISO 14043 Interpretarea ciclului de viață – vizează modalitățile de interpretare a datelor respectând următorii pași obligatorii:

- Descriere generală a interpretării ciclului de viață
- Identificarea problemelor semnificative
- Evaluare
- Concluzii și recomandări
- Raportare
- Alte investigații

SR ISO-TS 14048 Format al documentației referitoare la date detaliază și prezintă chiar structura

tabelelor utilizate în elaborarea studiilor LCA.

Din această perspectivă și pe baza experienței practice acumulate în implementări, **Sistemul** impune înregistrările prezentate în tabelul 3.

Tabel 3 Proceduri și Formulare introduse suplimentar de standardele de referință 14040

Documentul
F-3-1 Termeni și definiții
PO-6.4-40 LCA – Principii și cadru de lucru (SR EN ISO 14040)
PO-6.4-40-1 LCA – Definierea scopului, domeniului de aplicare și analiza de inventar (SR EN ISO 14041)
F-6.4-40-1-1 Fișă de date de intrare pentru transportul de aprovizionare
F-6.4-40-1-2 Fișă de date pentru mijloacele de transport intern
F-6.4-40-1-3 Fișă de date pentru unitatea de proces
F-6.4-40-1-4 Fișă de centralizare a datelor pentru analiza inventarului ciclului de viață
PO-6.4-40-2 LCA – Evaluarea impactului ciclului de viață (SR EN ISO 14042)
PO-6.4-40-3 LCA – Interpretarea ciclului de viață (SR EN ISO 14043)
F-6.4-40-3-A1 Structurarea datelor de intrare și de ieșire LCI pentru etapele ciclului de viață
F-6.4-40-3-A2 Procentajul contribuțiilor datelor de intrare și de ieșire ale LCI în etapele ciclului de viață
F-6.4-40-3-A3 Ierarhizarea datelor de intrare și de ieșire ale LCI pentru etapele ciclului de viață
F-6.4-40-3-A4 Matricea de structurare grupată în grupuri de procese
F-6.4-40-3-A5 Clasificarea după gradul de influență al datelor de intrare și de ieșire ale LCI aranjate în grupuri de procese
F-6.4-40-3-A6 Marcarea anomaliilor și a rezultatelor neașteptate ale datelor de intrare și de ieșire în grupurile de procese
F-6.4-40-3-A7 Structurarea rezultatului Indicatorului de categorie (GWP) față de etapele ciclului de viață
F-6.4-40-3-A8 Structurarea rezultatului indicatorului de categorie (GWP) față de etapele ciclului de viață, exprimată în procente
F-6.4-40-3-A9 Conținutul verificării de completitudine
F-6.4-40-3-A10 Verificarea de senzitivitate a regulilor de alocare
F-6.4-40-3-A11 Verificarea de senzitivitate aplicată la incertitudinea datelor
F-6.4-40-3-A12 Verificarea de senzitivitate aplicată la caracterizarea datelor
F-6.4-40-3-A13 Rezultatele unei verificări de consecvență
PO-6.4-40-8 LCA - Format al documentației referitoare la date (SR ISO-TS 14048)
F-6.4-40-8-A1 Proces
F-6.4-40-8-A2 Modelare și validare
F-6.4-40-8-A3 Informații administrative
F-6.4-40-8-B1 Proces
F-6.4-40-8-B2 Elemente de intrare/Elemente de ieșire
F-6.4-40-8-B3 Modelare și validare
F-6.4-40-8-B4 Informații administrative

2. CORELAREA CERINȚELOR STANDARDELOR REFERENȚIALE SERIA ISO 14040 CU CERINȚELE STANDARDULUI ISO 9001

Deși se declară de la început, continuatoarele ale standardului *SR EN ISO 14001 Sistem de management de mediu* abordarea LCA ține mai mult de “*impacturile posibile asociate produselor fabricate și consumate*” fiind clar vizibilă trecerea prin toate clauzele referențialului de bază *SR EN ISO 9001*. [5]

Corelația primelor trei capitole este evidentă: Domeniu de aplicare, Referințe normative, Termeni și definiții apar în toate standardele de referință iar implementarea impune dezvoltarea și detalierea acestora.

În tabelul 4 sunt prezentate o parte dintre corelațiile pe Clauza 4. Dacă în ISO 9001 Controlul documentelor și Controlul înregistrărilor sunt cerințe critice, în LCA acestea devin fundamentale, pentru că realizarea unui studiu amplu nu se poate face fără un volum mare de informații perfect documentate și înregistrări foarte bine sistematizate – de la toate Firmele/Sistemele fluxului *sistem-produs* definit. [6,7]

Tabel 4 Corelații între clauza 4 a ISO 9001 și referențialele seriei ISO 14040

Clauza ISO 9001:2008		Clauze LCA	
4	Sistem de management al calității	SR EN ISO 14040	4 Descrierea generală a LCA
4.2.3	Controlul documentelor	SR EN ISO 14040	Principii și cadru de lucru.
		SR EN ISO 14043	Interpretarea ciclului de viață
		SR EN ISO 14048	Format al documentației
4.2.4	Controlul înregistrărilor	SR EN ISO 14040	6 Raportare
		SR EN ISO 14041	4 Componente ICV
			5 Definierea scopului și domeniului de aplicare
			Anexa A Exemple de Fișe de Colectare a Datelor
		SR EN ISO 14042	10 Raportare și analiză critică
SR EN ISO 14043	8 Raportare		
	Anexa A Exemple de interpretare a ciclului de viață		

		SR ISO-TS 14048	Format al documentației referitoare la date
--	--	-----------------	---

Orientarea către client, atât de vagă în ISO 9001 capătă în LCA adevărată dezvoltare (tabelul 5): în cadrul fluxului sistem-produs fiecare Firmă/Sistem trebuie să-și definească utilitatea și aportul de valoare adăugată așa fel ca întregul sistem să-și găsească utilitatea și aportul de valoare adăugată pe piața concurențială. De exemplu, fiecare Firmă se străduiește să satisfacă cerințele unui proces anume (ex. producție de mere, transport, exploatare forestieră, colectare maculatură, producție de hârtie, producție de carton ondulat, etc.) pentru a fi admisă în fluxul *sistem-produs*.

Tabel 5 Corelații între clauza 5.2 a ISO 9001 și referențialele seriei ISO 14040

Clauza ISO 9001:2008		Clauze LCA	
5.2	Orientare către client	SR EN ISO 14043	4 Descriere generală a interpretării ciclului de viață

Planificarea și stabilirea Obiectivelor la nivel de Sistem trebuie detaliate în LCA (tabelul 6) pentru toate componentele.

Tabel 6 Corelații între clauza 5.4 a ISO 9001 și referențialele seriei ISO 14040

Clauza ISO 9001:2008		Clauze LCA	
5.4	Planificare	SR EN ISO 14043	5 Identificarea problemelor semnificative
5.4.1	Obiectivele calității	SR EN ISO 14043	5.1 Obiectiv

Analiza de management și Auditurile interne (tabelul 7) devin critice în menținerea pe piață a Sistemului. Este foarte important ca toate înregistrările definite să fie monitorizate și interpretate de experți interni și externi independenți.

Tabel 7 Corelații între clauzele 5.6 și 8.2.2 a ISO 9001 și referențialele seriei ISO 14040

Clauza ISO 9001:2008		Clauze LCA	
5.6	Analiza efectuată de management	SR EN ISO 14040	7 Analiza critică
		SR EN ISO 14041	5 Definirea scopului și domeniului de aplicare
			6 Analiza de inventar
			7 Limitarea ICV (interpretarea rezultatelor ICV)
			8 Raportul Studiului
		SR EN ISO 14042	7 Analiza calității datelor
			10 Raportare și analiză critică
		SR EN ISO 14043	4 Descriere generală a interpretării ciclului de viață
			6 Evaluare
			7 Concluzii și recomandări
8.2.2	Audit intern	SR EN ISO 14040	7 Analiza critică
		SR EN ISO 14041	5 Definirea scopului și domeniului de aplicare
			6 Analiza de inventar
			7 Limitarea ICV (interpretarea rezultatelor ICV)
			8 Raportul Studiului
		SR EN ISO 14042	10 Raportare și analiză critică
		SR EN ISO 14043	7 Concluzii și recomandări

Realizarea produsului/serviciului, într-un sistem-produs, trebuie să urmărească îndeplinirea Clauzei 7 (conform tabelului 8), din fiecare subsistem, procedurat clar, astfel încât să se asigure satisfacția atât a clienților externi cât și a celor interni. Clienții interni sunt firmele/sistemele componente care alcătuiesc un lanț al cărui rezistență este dată de veriga cea mai slabă.

Tabel 8 Corelații între clauza 7 a ISO 9001 și referențialele seriei ISO 14040

Clauza ISO 9001:2008		Clauze LCA	
7.1	Planificarea realizării produsului	SR EN ISO 14040	5 Cadru metodologic
		SR EN ISO 14041	4 Componente ICV
			5 Definirea scopului și domeniului de aplicare
			6 Analiza de inventar
			7 Limitarea ICV (interpretarea rezultatelor ICV)
		SR EN ISO 14042	4 Descriere generală a LCIA
		SR ISO-TS 14048	Format al documentației referitoare la date
7.5	Producție și furnizare de servicii (numai titlu)	SR EN ISO 14040	5 Cadru metodologic
		SR EN ISO 14042	5 Elemente obligatorii
			6 Elemente Opționale
			8 Limitări ale LCIA
		SR EN ISO 14043	6 Evaluare
			7 Concluzii și recomandări
		9 Alte investigații	

CONCLUZII

În ultimii ani s-a acumulat un volum important de materiale privind studiile LCA, inclusiv în domeniul celulozei și hârtiei, care uneori prezintă puncte de vedere și argumente diferite. Din acest motiv, se recomandă respectarea metodologiei din standardele de referință seria SR EN ISO 14040, inclusiv privind procedurile și înregistrările impuse de acestea.

Este necesară o viziune managerială de ansamblu, care să coreleze acțiunea sistem - produs atât în ansamblu cât și pe părți (sub-sisteme) componente. Studiul LCA impune ca analiza datelor să fie realizată de experți independenți, preferabil externi, pentru a i se asigura obiectivitatea.

Deocamdată, nu se cunosc organisme de certificare acreditate pe standardele referențiale

seria SR EN ISO 14040, dar creșterea cererii de studii LCA va determina înființarea lor la nivel central și zonal.

BIBLIOGRAFIE

1. Declarația de mediu EGGER – <http://www.egger.com/pdf/ZF EPD EGGER DPR EN 2009 Kurzfassung.pdf>
2. R.Coles, D. McDowell, M. J. Kirwan, *Food Packaging Technology*, Blackwell Publishing Ltd, 2003
3. *Analyse du cycle de vie des caisses en bois, carton ondulé et plastique pour pommes – Synthèse : Version finale (L045-S4) Préparée par ECOBILAN*
4. ADEME, *Evaluation des impacts environnementaux des sacs de caisse Carrefour*, Rapport préparé pour Carrefour, 2004
5. A. Iosip, E. Bobu, *Analiza impactului de mediu al produselor și proceselor prin evaluarea ciclului de viață (LCA)*, Revista de Celuloză și Hârtie, vol.59, nr.1, 2010, p. 3
6. Urbaneco, *Eco Arhitectura, Aplicații tehnologice în ecologie*, <http://ggreenn.ecosapiens.ro/eco-arhitectura-aplicatii-tehnologice-in-ecologie/>
7. V.I. Adomnicăi, *La frontiera comună a județului Suceava cu Regiunea Cernăuți*, Proiect european de mediu, 11.05.2006

CELLULOSE CHEMISTRY AND TECHNOLOGY

Rezumatele lucrărilor publicate în
Abstracts of papers published in

Vol. 43 (2009)

REACTION OF BIXIN WITH ETHYLCELLULOSE IN *N,N*- DIMETHYLFORMAMIDE (*N,N*-DMF)

GABRIEL OLATUNJI and SUNDAY OLADOYE*

Chemistry Department, University of Ilorin, Nigeria

**Department of Pure and Applied Chemistry, Ladoko Akintola University of Technology,
Ogbomoso, Nigeria*

The reaction of ethylcellulose with bixin in *N,N*-dimethylformamide and a catalytic amount of anhydrous sodium acetate gave a product characterized by its UV, IR and ¹H-NMR spectra data as a reduction product of the bixin-ethylcellulose ether.

EFFECTS OF KRAFT PULPING VARIABLES ON PULP AND PAPER PROPERTIES OF *ACACIA MANGIUM* KRAFT PULP

W. D. WAN ROSLI, I. MAZLAN and K. N. LAW*

School of Industrial Technology, University Sains Malaysia, 11800 Penang, Malaysia

**Centre Intégré en Pâtes et Papiers, Université du Québec à Trois-Rivières,
P. O. Box 500, Trois-Rivières, Québec, Canada G9A 5H7*

The influence of the pulping variables (active alkali charge, sulfidity, temperature and pulping time) on the pulp yield, Kappa number and strength properties of *Acacia mangium* kraft pulp was examined. The dissolution of wood components was seen as particularly sensitive to the variations produced in active alkali charge and cooking temperature. To optimize the process, one may use either high doses of chemicals (active alkali and sulfidity), as well as low temperature and short cooking time, or *vice versa*. When beaten to a freeness of 500 mL and a 50% yield, the Kraft pulp from *A. mangium* evidenced excellent physical properties.

EFFECTS OF THE ENDOXYLANASE TREATMENT ON FIBER CHARACTERISTICS, BRIGHTNESS STABILITY AND STRENGTH PROPERTIES OF BLEACHED WHEAT STRAW PULP

SAIM ATES, YONGHAO NI* and CELIL ATIK**

*Kastamonu University, Faculty of Forestry, Department of Forest Industrial Engineering,
37200, Kastamonu, Turkey*

**Limerick Pulp Paper Centre, University of New Brunswick, Fredericton, NB, E3B6C2,
Canada*

***Istanbul University, Faculty of Forestry, Department of Forest Industrial Engineering,
80895, Bahcekoy – Istanbul, Turkey*

The pretreatment of soda-anthraquinone (AQ) wheat straw pulp with purified endo-(1,4)- β -xylanase was studied. Different xylanase dosages (0, 2, 20 and 100 IUg⁻¹) were applied to the pulp before an ECF (Elemental Chlorine Free) bleaching sequence. The fiber characteristics, brightness stability and strength properties of the obtained pulps were determined. The results showed that the fiber characteristics were not significantly affected by the enzyme pretreatment. On the other hand, the xylanase pretreatment lowered the strength properties of the pulp. A slight improvement in lignin removal was observed, thus improving pulp bleachability, the results agreeing with those obtained on wood pulps. Furthermore, higher paper brightness stability was obtained by the xylanase pretreatment, explained by the removal of the metal ions from the pulp samples.

MATHEMATICAL MODELING OF A ROTARY VACUUM WASHER USED FOR PULP WASHING: A CASE STUDY OF A LAB SCALE WASHER

V. K. KUKREJA and A. K. RAY*

*Department of Mathematics, Sant Longowal Institute of Engineering and Technology,
Longowal - 148106 (Punjab), India*

**Department of Paper Science, IIT Roorkee, (Saharanpur Campus), Saharanpur - 247001
(UP), India*

Mathematical models for the different zones of a rotary vacuum washer are presented in terms of their fundamental parameters. Filter performance is expressed in terms of washing liquor usage, solute removal and efficiency parameters. Laboratory experiments are performed on a combination of Indian hardwood (eucalyptus, bamboo and pine) pulp collected from a paper mill. The influence of interstitial velocity, cake thickness, Peclet number, bed porosity and dilution factor on the commonly used industrial parameters, such as washing efficiency, displacement ratio, Norden efficiency factor, is examined. The proposed model can be used in developing computer codes for online monitoring of the process.

ON THE DEFORMATION PROPERTIES OF HIGH YIELD FIBRE MATERIALS BY UNDESTRUCTIVE METHODS

VESKA LASHEVA and MARIA KARSHEVA *

Department of Cellulose, Paper and Packing

**Department of Chemical Engineering University of Chemical Technology and Metallurgy,
1756 Sofia, Bulgaria*

High yield fibre material chemi-mechanical pulp (CMP), obtained after the treatment of poplar wood with sodium hydroxide solutions and green liquor, was studied at different degrees of grinding, as well as in composition with cellulose. The stress-deformation curves were derived and the effect of loading time on elastic deformation was shown. The time and rate of loading necessary to decrease the stress in the samples tested at constant deformation were studied. The slip modulus, characterizing the non-uniformity in cellulose and paper samples, was determined. The application of undestructive methods for the analysis of fibrous materials gives the possibility to predict their physico-mechanical properties and the behaviour of the paper under exploitation conditions.

COMBINED APPLICATIONS OF CATIONIC FLOURS AND ENZYMATICALLY MODIFIED SUGAR BEET PULP IN PAPERMAKING

MÁRIA FIŠEROVÁ, JURAJ GIGAC and ŠTEFAN BOHÁČEK

*Pulp and Paper Research Institute, Lamačská cesta 3,
841 04 Bratislava, Slovak Republic*

The influence of cationic wheat flours on the properties of suspensions and laboratory handsheets prepared from a mixture of saq semichemical pulp and recovered fibres, with and without addition of enzymatically modified sugar beet pulp (EMSBP), was investigated. The main effects of cationic flour and emsbp are related to the improvement of handsheet strength properties (tensile and burst index, internal bond strength, cmt_{30} and bending resistance), which are higher in the case of simultaneous addition of cationic starches and enzymatically modified sugar beet pulp than in the case of separate addition. It was also observed that cationic flours partially compensate the negative influence of the enzymatically modified sugar beet pulp on drainage time and filtrate loading (COD, BOD_5), as well as on the bending resistance and air permeability of handsheets.

PLUG WRAP PAPERS

OZNUR OZDEN

Istanbul University, Forest Faculty, Department of Forest Product Chemistry and Technology Bahcekoy, 34473, Sariyer, Istanbul, Turkey

Cigarette paper is the wrapping material surrounding the tobacco to form a cigarette rod. Cigarettes can be made from tobacco, filter cigarette paper and filter papers. Filter papers contain plug wrap papers and tipping papers. The permeability range of the highly porous plug wrap papers is one of their most important properties. In addition, other properties, such as mass (g/m^2), breaking length, opacity and texture should be considered. Most papers are naturally porous, their pores occur during paper sheet formation.

In this study, three different pulps were used to produce plug wrap papers. Permeability and other tests were performed to reach the final objective of obtaining highly porous plug wrap papers for producing cigarette filters. To do this, a correlation is established between the permeability of plug wrap papers and the pulp mixtures. Usually, the type and amount of cellulose affect permeability. In the study, a suitable mixture of sisal and eucalyptus pulps (70% sisal + 30% eucalyptus) for plug wrap papers was employed.

DIFFERENCES IN THE RECYCLING BEHAVIOUR OF PAPER PRINTED BY VARIOUS TECHNIQUES

NELA DUMEA, ZOLTAN LADO* and EMANUEL POPPEL**

SC Letea SA Bacău, Letea 17, Bacău 600122, Romania

**Ceprohart Brăila – Suceava Branch, Suceava 720019, Romania*

***“Gh. Asachi” Technical University of Iași, Faculty of Chemical Engineering and Environmental Protection, Iași 700050, Romania*

The diversification of existing printing methods represents a great challenge for papermakers who utilize wastepaper in production processes. Prior to reuse, secondary fibres are subjected to some processing steps, for recovering their initial papermaking potential. Depending on the extent of recovering, the obtained fibrous material will be more or less recommended for the production of new paper products.

The present paper approaches the deinking ability of offset, flexographic and digital prints in laboratory flotation deinking.

ALKALINE PEROXIDE TREATMENT FOR IMPROVING THE PAPERMAKING PROPERTIES OF RECYCLED UNBLEACHED SOFTWOOD KRAFT PULPS

M. A. ZANUTTINI, V. A. MARZOCCHI and P. MOCCHIUTTI

*Instituto de Tecnología Celulósica, Facultad de Ingeniería Química,
Universidad Nacional del Litoral, Santiago del Estero 2654,
S3000AOJ, Santa Fe, Argentina*

The main shortcoming of the papermaking properties of recycled fibres refers mainly to the hornification effect, as a consequence of drying during papermaking. An alkaline treatment is potentially useful to reverse this effect. The present paper discusses the consequences of alkaline and alkaline peroxide treatments on unbleached recycled softwood kraft pulp (Kappa number: 92). A 3² factorial experimental design was applied, on considering the following factors: a) total alkaline charge and b) total peroxide charge. The chemical oxygen demand values were used for evaluating the material loss. It was found out that the delignifying effect of alkali was enhanced by peroxide addition. The alkaline treatment reduced freeness and improved the papermaking properties, such as tensile strength, Concora crush strength and short column compressive strength. Also, the addition of peroxide increased the papermaking properties even more, while the material loss caused a considerable increase in the organic charge of the effluents.

INFLUENCE OF PRESSING AND DRYING ON THE MICROSTRUCTURE OF RECYCLED PLANT FIBERS

JINQUAN WAN, YAN WANG, YONGWEN MA and QING XIAO

*College of Environmental Science and Engineering, South China University of Technology,
Guangzhou, China, 510640*

The influence of pressing and drying on the microstructure of wheat straw fiber during reuse processes was studied. The results showed that, at an applied pressure below 4 MPa, the WRV loss rate was of 7.96%, while, at pressures over 4MPa, it was of 25.90%. When pressure increased from 1MPa to 5 MPa, cellulose crystallinity increased also, and the fiber cell wall pores closed to a great extent. With increasing pressure from 1 to 5 times, WRV decreased. However, cellulose crystallinity increased with increasing the number of pressings. Fiber pores were irreversibly and significantly closed after the first pressing while, with an increasing number of pressings, the changes observed in pore size and distribution of fibers were insignificant. When the drying temperature increased from 60 to 120 °C, cellulose crystallinity increased to 84.6% and the average pore volume corresponding to the mesopore decreased by $5.42 \times 10^{-5} \text{ cm}^3/\text{g}$. In addition, WRV decreased, cellulose crystallinity increased and the degree of non-reversible closure was enhanced, when increasing the drying time at 100 °C. Electronic microscope photographs evidence no non-restorable collapse deformation and folds on the fiber cell wall after pressing and drying, which modified the sizes and shapes of the fiber cell wall.

INFLUENCE OF THE COMPOSITION OF POLYVINYL CHLORIDE – PLASTISOLS – COMPONENTS ON THE PROPERTIES OF STRUCTURED WALLPAPERS

T. BOSHKOVA, D. ROZALINOV, D. TODOROVA and A. GANCHEV

Department of Pulp, Paper and Polygraphy, University of Chemical Technology and Metallurgy 8, Kl. Ohridski Blvd. – 1756 Sofia, Bulgaria

The large diversity of utility wallpapers provided on local and world markets is considerable, determining an increased demand and enhancing both quality and aesthetic claims.

A thorough research on the composition of some basic components of polyvinyl chloride (PVC) pastes (plastisols)¹ is a prerequisite for assuring a high quality production, optimal optic features (whiteness, opacity, gloss), suitable viscosity and behavior at foaming, foam structure homogeneity, thermal and mechanical stability at layering, and perfect adhesion.

The present paper investigates the influence of some basic components of PVC pastes on coating whiteness, opacity and viscosity. Three types of paper have been used. The recipes for the PVC pastes used in the preparation of various structured wallpapers have been formulated and particularized under laboratory conditions.

The results obtained show that:

- PVC paste viscosity depends on the coarseness of the PVC component particles, seen as diminishing with their increase, as a result of lower dispersion, lower stability and lower uniformity.
- Time-stability of the PVC paste viscosity depends on particle coarseness and plasticizer's molecular mass and gelatinizing ability. The average values of the molecular mass and of the final gelatinizing ability of the plasticizer give PVC pastes with minimal viscosity deterioration in time.

A COMPARISON BETWEEN ALKALINE EARTH METAL CHLORIDES AND THEIR CARBONATES AS FLAME-RETARDANTS FOR COTTON FABRICS

SEYED MOTERZA MOSTASHARI

Faculty of Science, University of Gilan, P.O. Box 1914, Rasht, Iran

The comparative effect of alkaline earth chlorides and/or carbonates on the flammability of a cotton fabric has been investigated. The vertical flame spread test evidenced that the optimum loading of both alkaline earth chlorides and/or carbonates increased with increasing their molecular weight, the explanation of this phenomenon being provided by the Free-Radical, Gas and Dust or Wall Effect theory. Moreover, the superiority of alkaline earth chlorides, with regard to their carbonates, on the flame-retardancy of cotton fabrics was verified.

THERMOGRAVIMETRIC ANALYSIS OF A CELLULOSIC FABRIC TREATED WITH NICKEL SULFATE HEXAHYDRATE AS A FLAME-RETARDANT

S. M. MOSTASHARI, O. BAGHI and S. Z. MOSTASHARI

Faculty of Science, University of Gilan, Rasht, Iran

The effect of nickel sulfate hexahydrate ($\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$) on the flammability of cotton fabric was investigated and the optimum add-on value of nickel sulfate for imparting flame-retardancy to cotton fabric was calculated (as 11.8-14.3 g anhydrous salt per 100 g fabric). Thermogravimetric analyses of pure cotton, treated cotton and pure salt were accomplished, and their thermograms were compared. The results obtained agree with the Gas theory expressing water expulsion over a certain duration of the thermal degradation zone of cellulose. In fact, this occurs over a desirable range, prior to the initiation of cellulose thermal decomposition.

SPHAGNUM MOSS PEAT AS A POTENTIAL SORBENT AND REDUCTANT FOR CHROMIUM (VI) REMOVAL FROM AQUEOUS SOLUTIONS

CATALIN BALAN, DOINA BILBA and MATEI MACOVEANU

“Gh. Asachi” Technical University, Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management, 71A, D. Mangeron Blvd., 700050 Iași, Romania

Batch sorption experiments were carried out for the removal of chromium (VI) ions from aqueous solutions using the Romanian *sphagnum* moss peat. Similar to many biomaterials, peat removes Cr (VI) by a mechanism of “sorption-coupled reduction”, involving both the sorption, in acidic media, of the hydrochromate anion on the peat surface and the reduction, in the solution, of toxic Cr (VI) to less toxic Cr (III). Reduction and sorption processes were investigated as a function of the initial pH of the solution, peat dose, metal ion concentration and contact time. Removal of Cr (VI) is enhanced by lower pH values (pH = 1-2), while a peat dose of 8 g/L assures an almost complete removal of Cr (VI) from solutions with an initial concentration of 50 mg/L. The experimental results point out the potential of *sphagnum* moss peat, an available natural material, in removing Cr (VI) from wastewater.

WHEAT STRAW PYROLYSIS ANALYSIS BY THERMOGRAVIMETRY AND GAS CHROMATOGRAPHY–MASS SPECTROMETRY

QING YANG and SHUBIN WU

State Key Laboratory of Pulp Paper Engineering, South China University of Technology, Guangzhou, Guangdong 510640, P. R. China

The effect of the heating rates and the existence of a Ni-catalyst on the thermogravimetric characteristics of wheat straw were investigated by thermogravimetry and gas chromatography–mass spectrometry. The weight loss of wheat straw was not markedly influenced by the heating rates, over a temperature range from 220.6 to 391.2 °C, although, to obtain the same weight loss, the corresponding temperature was increased and the heating rates were enhanced. The thermogravimetric kinetic parameters of wheat straw were calculated both without catalyst and with 0.5% Ni-catalyst, by the method of Kissinger; the apparent activation energy values of wheat straw were of 93.92 and 119.80 KJ·mol⁻¹, and the frequency factors $\ln A$ were of 17.82 and 23.02 min⁻¹, respectively. The weight loss of wheat straw was not markedly influenced by the Ni-catalyst, while pyrolysis–gas chromatography–mass spectrometry (Py-GC-MS) evidenced that, at 800 °C, the presence of the catalyst influenced the peak intensities derived from cellulose, hemicellulose and lignin. It was concluded that the Ni-catalyst favors a more catalytic effect on wheat straw lignin, that is, the total value of the peak area from phenolic compounds and vanillin was higher than that from furfural and levoglucosan.

THERMOGRAVIMETRIC CHARACTERISTICS OF WHEAT STRAW LIGNIN

QING YANG and SHUBIN WU

State Key Laboratory of Pulp and Paper Engineering, South China University of Technology, Guangzhou, Guangdong 510640, P. R. China

The thermogravimetric characteristics of wheat straw EMAL (Enzymatic Acidolysis Lignin) were analyzed. The effect of the heating rates on the thermogravimetric characteristics of wheat straw and the wheat straw influence on pyrolysis were investigated. The influence of various heating rates on wheat straw was significant, the pyrolysis rate of wheat straw EMAL increased at temperatures between 200 and 500 °C. At a temperature above 200 °C, the pyrolysis rate of wheat straw EMAL was clearly accelerated, since all DTG curves and the maximum temperature corresponding to pyrolysis shifted to high temperature areas, two maxima being also recorded on the DTG curves. The thermogravimetric dynamics parameters of wheat straw were calculated by the methods of Kissinger and Ozawa, respectively; the activation energy of wheat straw EMAL was of 103.92 and 107.69 KJ·mol⁻¹, respectively, and the frequency factor, $\ln A$, of 19.21 and 20.60 min⁻¹. The fitting degree of the Kissinger method was better than that of the Ozawa one. At a pyrolysis temperature over 400 °C, the influence of the lignin present in wheat straw on wheat straw thermal behavior was very clear, lignin pyrolysis dominating over that of wheat straw.

THERMOGRAVIMETRIC CHARACTERISTICS OF WHEAT STRAW LIGNIN

QING YANG and SHUBIN WU

*State Key Laboratory of Pulp and Paper Engineering, South China University of
Technology, Guangzhou, Guangdong 510640, P. R. China*

The thermogravimetric characteristics of wheat straw EMAL (Enzymatic Acidolysis Lignin) were analyzed. The effect of the heating rates on the thermogravimetric characteristics of wheat straw and the wheat straw influence on pyrolysis were investigated. The influence of various heating rates on wheat straw was significant, the pyrolysis rate of wheat straw EMAL increased at temperatures between 200 and 500 °C. At a temperature above 200 °C, the pyrolysis rate of wheat straw EMAL was clearly accelerated, since all DTG curves and the maximum temperature corresponding to pyrolysis shifted to high temperature areas, two maxima being also recorded on the DTG curves. The thermogravimetric dynamics parameters of wheat straw were calculated by the methods of Kissinger and Ozawa, respectively; the activation energy of wheat straw EMAL was of 103.92 and 107.69 KJ·mol⁻¹, respectively, and the frequency factor, *lnA*, of 19.21 and 20.60 min⁻¹. The fitting degree of the Kissinger method was better than that of the Ozawa one. At a pyrolysis temperature over 400 °C, the influence of the lignin present in wheat straw on wheat straw thermal behavior was very clear, lignin pyrolysis dominating over that of wheat straw.

CONTROLLED RELEASE OF WATER SOLUBLE ANTIBIOTICS BY CARBOXYMETHYLCELLULOSE- AND GELATIN-BASED HYDROGELS CROSSLINKED WITH EPICHLOROHYDRIN

GABRIELA BUHUS*, CATALINA PEPTU, MARCEL POPA and
JACQUES DESBRIÈRES*

*Department of Natural and Synthetic Polymers, "Gheorghe Asachi" Technical University of
Iași, 71, Blvd. D. Mangeron, 700050 Iași, Romania*

**Université de Pau et des Pays de l'Adour, IPREM/EPCP (UMR CNRS 5254), Hélioparc
Pau Pyrénées, 2, Avenue Président Angot, 64053 Pau Cedex 09, France*

Hydrogels based on carboxymethylcellulose (CMC) and gelatin (GEL) crosslinked with epichlorohydrin in alkaline environment are polymeric interpenetrated-interconnected network materials, designed for obtaining controlled release polymer-drug systems. CMC and GEL are chosen due to their biocompatibility and non-toxicity – compulsory conditions for the polymers used in biomedical applications. By modifying the parameters of the crosslinking reaction, the obtained networks present different crosslinking degrees and hence different swelling capacities, properties determining the quantity of the drug to be included. Hydrogels with the highest swelling degree were loaded with water soluble drugs (chloramphenicol - sodium hemisuccinate, ClPh). We have thus obtained systems with diffusion-controlled release, with zero-order kinetics during most of the release period. These systems prove a high bactericide activity, comparable to that of free drugs.

ON THE THERMAL STABILITY OF FLAX FABRICS GRAFTED WITH MONOCHLOROTRIAZINYL- β - CYCLODEXTRIN AND TREATED WITH CINNAMIC DERIVATIVES

ANA-MARIA GRIGORIU, CONSTANTIN LUCA*, GABRIELA LISA*
and AURELIA GRIGORIU

*Faculty of Textiles and Leather Engineering, "Gheorghe Asachi" Technical University,
53, D. Mangeron Blvd., 700050, Iași, Romania*

**Faculty of Chemical Engineering, "Gheorghe Asachi" Technical University,
71A, D. Mangeron Blvd., 700050 Iași, Romania*

Cyclodextrins are among the most frequently used host molecules in inclusion compounds chemistry, with a wide applicability in different fields, including the textile industry.

The thermal stability over the 25-900 °C temperature range of several flax samples grafted with monochlorotriazinyl- β -cyclodextrin and treated with cinnamic derivatives (ferulic acid, caffeic acid, ethyl ferulate) has been studied. The influence of the heating rate and atmosphere (air and nitrogen) under which the thermal degradation of the investigated samples occurred was also underlined.

The thermal methods (TGA, DSC) applied to the flax grafted with MCT- β -CD and treated with different cinnamic derivatives have evidenced a complex mechanism of thermal degradation.

The degradation mechanisms of the investigated flax samples are similar, consisting of two stages: in the former, the physically bonded water is removed (approximately 4%) while, in the latter, the mass loss is of about 75-80%.

INFLUENCE OF ALKALINE AND ALKALINE/OXIDATION PRETREATMENTS OF HORNBEAM WOOD ON THE PROPERTIES OF KRAFT PULP

RASTISLAV SOLÁR, JARMILA GEFFERTOVÁ, MIROSLAV
MAMOŇ*,
ANTON GEFFERT and BOŽENA KOŠÍKOVÁ**

Department of Chemistry and Chemical Technologies, Technical University in Zvolen

**Department of Wood Sciences, Technical University in Zvolen*

***Institute of Chemistry, Slovak Academy of Sciences, Bratislava, Slovak Republic*

A series of comparable specimens of hornbeam wood were pretreated with diluted sodium hydroxide, sodium hydroxide and hydrogen peroxide, or peracetic acid sequences. Under identical conditions of kraft cooking, all pretreatments improved the digestibility of hornbeam wood. Pulps from pretreated wood differed much from that obtained from untreated wood. Pretreatments reduced the yield of the pulps, diminished their Kappa number noticeably, reduced the degree of polymerisation and increased extremely their brightness. One-step peroxide bleaching of pulps from pretreated wood gave a much higher brightness, compared to that of bleached pulp from sound wood. Bleached, unrefined pulps from sound and pretreated wood evidenced different fibre dimensions, as well as a different distribution according to length and width. Unexpected, however, was the higher consumption of energy for refining bleached pulps from pretreated wood. Pretreatments increased the rate of pulp interactions with water in the initial phase of wetting, but markedly reduced the final value of their swelling. Pretreatments also improved the breaking length and tear index of the sheets from bleached, refined pulps. From the viewpoint of improved pulp properties, the most efficient pretreatments were the sodium hydroxide/peracetic acid and sodium hydroxide/activated H₂O₂ sequences.

OPTIMIZING ALKALINE SIZING IN SUGAR CANE BAGASSE PAPER RECYCLING

LILIANA BEATRIZ MOLINA TIRADO, MARIA CRISTINA AREA* and
HUGO ENRIQUE VÉLEZ

INTI – Celulosa y Papel, Av. General Paz 5445, B1650KNA San Martín, Buenos Aires, Argentina

**PROCYP – UNAM, Posadas, Misiones, Argentina*

The objective of this work was the variation of additives dosage in the sizing treatment of sugar cane bagasse paper for liners and flutings, on taking into account the cycles of use, for reaching the same sizing degree in each cycle. The degradation of the physical properties under different conditions of relative humidity and temperature for each stage of the papermaking cycle was also studied.

The sizing agent utilized was the alkyl ketene dimer (AKD). Cationic starch and a retention agent (a modified high molecular weight polyethylenimine) were also added. The experimental design applied was a Central Composite Design (CCD). Once the optimum dosage of additives found, the sheets were submitted to different conditions of humidity and temperature, and their physical properties were tested. Three papermaking cycles were carried out: a papermaking cycle, followed by two recycles.

It was observed that a lower amount of AKD was required to reach the water absorption objective (measured by the Cobb₁₂₀ test), as it progresses during the papermaking cycles, and also that good properties in liner and fluting paper could be attained in spite of the recycles, although, at 75% relative humidity (RH), the liner and fluting properties drastically decreased.

WATER CHARACTERISTICS SUITABILITY FOR TEXTILE WET PROCESSING AND ITS REMEDY MEASURES

MAHMUDA BEGUM, MUBARAK HOSSEN and AYESHA KHATTON

Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka-1207, Bangladesh

Numerous impurities always occur in various sources of water. Water is a unique solvent, which dissolves most of the inorganic and organic compounds. These comprise acidic and alkaline compounds, and dissolved oxygen. The content of impurities in the water used in textile wet processing was investigated, because of their possible destructive effect on wet processes, machineries, boilers and other related materials. The present study was carried out according to standard titrimetric and redox reaction methods. Remedial measures were also studied for water adequacy.

THERMOGRAVIMETRIC INVESTIGATION ON THE FLAME-RETARDANCY OF LITHIUM BROMIDE ADDED TO COTTON FABRIC

S. M. MOSTASHARI and S. BAIE

*Chemistry Group, Faculty of Science, University of Gilan,
Rasht, Iran*

The present paper discusses the results obtained from the investigation on the effect that lithium bromide, as non-durable finish, exerts on the flammability of 100% cotton fabric (plain, 150 g/m²). The bone-dried weighed fabrics were impregnated with suitable concentrations of lithium bromide, through squeeze-rolling and drying. The samples were then cooled in a desiccator and reweighed with analytical precision. By using our *vertical flame spread tester*, the optimum add-on value for imparting flame-retardancy to cotton fabric was determined to be around 3.85 g lithium bromide per 100 g fabric. The thermogravimetric (TG/DTG) results obtained for both untreated and salt-supported cotton fabrics, at an optimum addition, were evaluated and their curves were compared and commented. The results obtained comply with condensed phase retardation, chemical action theory and gas dilution theory.

THE SUPERIORITY OF RED PHOSPHORUS OVER POLYMETAPHOSPHATE AS FLAME-RETARDANTS ON CELLULOSIC SUBSTRATES

S. M. MOSTASHARI

Faculty of Science, University of Gilan, Rasht, Iran

Red phosphorus and sodium polyphosphate, observed as efficient flame-retardants for cotton fabric, have been selected for a comparative study, in quantities evidenced as effective in the author's previously published papers. The vertical flame spread test method, applied for the evaluation of flame-retardancy, was observed to introduce the optimum loading for achieving flame-retardancy, the outcomes illustrating the superiority of red phosphorus over sodium polyphosphate. Thermogravimetric explanations agreed with the data of the vertical flame spread test, which might be beneficial for a better understanding of the action of red phosphorus versus sodium polyphosphate, in terms of flame-retardancy. It is deduced that the efficiency of flame-retardants depends on their structure, as well as on their physico-chemical characteristics.

INFLUENCE OF COMPONENTS RATIO UPON MECHANICAL PROPERTIES OF WOOD/THERMOPLASTIC POLYMER COMPOSITES

RUXANDA BODÎRLĂU, IULIANA SPIRIDON and CARMEN-ALICE
TEACĂ

“Petru Poni” Institute of Macromolecular Chemistry, Iasi – 700487, Romania

The thermal and mechanical properties of composites based on chemically modified wood with different ratios of thermoplastic polymers (LDPE, HDPE) as matrices were studied. The influence of content of chemically modified wood upon mechanical properties of wood/ thermoplastic polymer composites has been evidenced. For the temperature domain in which processing of the studied composites was performed, the used filler material slightly reduces the apparent thermal stability of the polymer matrix due to its complex structure, some specific biopolymer wood constituents being very susceptible to the thermal decomposition. As a general behavior, with increasing the chemically modified wood content in composite materials, the weight loss was lower. It was found that thermal and strength properties of the composites can be significantly improved by adding wood at different contents.

LEAD (II) REMOVAL FROM AQUEOUS SOLUTIONS BY ADSORPTION ONTO CHITOSAN

DOINA ASANDEI, LAURA BULGARIU and ELENA BOBU

*Faculty of Chemical Engineering and Environmental Protection, “Gheorghe Asachi”
Technical University, 700050 Iasi, Romania*

The adsorption behaviour of lead (II) ions from aqueous solutions onto chitosan was investigated. Adsorption experiments were performed in a batch system, at room temperature (20 ± 0.5 °C), by changing the various experimental parameters: initial solution pH, chitosan dosage, initial lead (II) concentration and contact time. The results have shown that the effectiveness of lead ions removal is mainly dependent on the initial concentration of lead ions to chitosan dosage ratio, which should be optimized by a compromise between the removal yield and cost-effectiveness of the process. The adsorption equilibrium data were analyzed by the Freundlich and Langmuir isotherm models, whose application for the mathematical description of lead (II) adsorption on chitosan indicated that the adsorption equilibrium is well-fitted to the Langmuir isotherm.

CHEMICAL COMPOSITION, CRYSTALLINITY AND CRYSTALLITE CELLULOSE SIZE IN *POPULUS* HYBRIDS AND ASPEN

XIAO-JUAN JIN and D. PASCAL KAMDEM*

School of Material Science and Technology, Beijing Forestry University, China

*Department of Forestry, Michigan State University, USA

The chemical composition (holocellulose, lignin, extractives and ash) of four *Populus* hybrid clones and an aspen sample was investigated. Statistical analyses indicated that no significant differences existed among the four *Populus* hybrid clones, although a notable discrepancy regarding the holocellulose content was found between aspen and the other four *Populus* hybrid clones. X-ray was used to study the crystallinity and the average thickness of cellulose crystallites in the four *Populus* hybrids and in aspen; the crystallinity index (Ic) ranged between 36.1 and 51.5%, and a negative correlation was found between the diameter breast height (DBH) and Ic (-0.85); thickness of the crystallite cellulose ranged from 5.67 to 7.09 nm, with no significant difference in the tree samples. No definite tendency was noticed, which is an obvious effect of wood ash application on DBH and Ic, and also on the thickness of crystallite cellulose.

FT-IR STUDY OF MAPLE WOOD CHANGES DUE TO CO₂ LASER IRRADIATION

IVAN KUBOVSKY and FRANTIŠEK KAČIK*

Department of Physics, Electrical Engineering and Applied Mechanics

**Department of Chemistry and Chemical Technologies*

*Faculty of Wood Sciences and Technology, Technical University in Zvolen, T.G. Masaryka
24, 960 53 Zvolen, Slovakia*

The paper reports on the wood component changes caused by laser beam irradiation. A 500 x 150 x 15 mm maple (*Acer pseudoplatanus* L.) board was irradiated by a CO₂ laser beam, at different values of exposure energy (expressed as irradiation dose). Changes in the absorption intensities due to degradation and condensation reactions of the main wood components were observed by infrared spectroscopy (FT-IR). When increasing the irradiation dose (from 18 to 57 Jcm⁻¹), the degradation of hemicelluloses was predominantly observed, while lignin was degraded at a lower irradiation dose and, at a higher energy dosage, lignin condensation occurred.

DISSOLVED STATE AND VISCOSITY PROPERTIES OF CELLULOSE IN A NaOH COMPLEX SOLVENT

SHUAI ZHANG, FA-XUE LI, JIAN-YONG YU* and GU LI-XIA**

Key Laboratory of Textile Science and Technology, Ministry of Education, Shanghai 201620, China and College of Textiles, Donghua University, Shanghai 201620, China

**Modern Textile Institute, Donghua University, Shanghai 200051, China*

***College Material Science Engineering, Donghua University, Shanghai 201620, China*

Cellulose may be quickly dissolved in a NaOH complex solvent (NaOH/urea/thiourea/H₂O). A detailed investigation on the effects of solvent composition and temperature on cellulose solubility has been presented. Optical microscopy and wide-angle X-ray diffraction (WAXD) were used to study the process of dissolution. The highest solubility of cellulose was recorded in NaOH/urea/thiourea/H₂O with an 8/8/6.5/77.5 composition, at -10 °C, although the components of this solvent cannot dissolve cellulose on their own, even at a low temperature. CP MAS ¹³C NMR spectra proved that, during regeneration, cellulose I (cotton linters) first changed to amorphous cellulose chains in solution and then to cellulose II. The intrinsic viscosity [η] of the cellulose solutions revealed that the cellulose complex occurs as flexible coil chains in the NaOH/urea/thiourea aqueous system, the chain stiffness of cellulose being higher than that of normal synthetic polymers, in a good solvent. According to relative viscosity measurements, the cellulose solution was stable during the storage stage.

A DRUG DELIVERY SYSTEM BASED ON STIMULI-RESPONSIVE ALGINATE/N-ISOPROPYLACRYL AMIDE HYDROGEL

RALUCA PETRONELA DUMITRIU, ANA-MARIA OPREA and CORNELIA VASILE

“Petru Poni” Institute of Macromolecular Chemistry, Department of Physical Chemistry of Polymers, 41 A, Gr. Ghica Voda Alley, 700487, Iasi, Romania

The release kinetics of paracetamol and theophylline from pH- and temperature-responsive hydrogel matrices prepared from sodium alginate and N-isopropylacryl amide crosslinked with N,N'-methylenebisacrylamide was investigated. The drug-loaded hydrogel matrices were studied by FT-IR spectroscopy. As the release kinetics of drugs is related to the kinetics of solvent diffusion into the hydrogels, studies on the swelling behavior become of great importance for appreciating the drug release from hydrogel matrices.

Swelling and release kinetic studies were performed at 37 °C in acid medium, at pH = 2.2, for simulating the pH of the gastric fluid in the stomach. The drug release kinetic data were analyzed and the release parameters were estimated by fitting the experimental data to three different theoretical models. The results obtained showed nearly similar release profiles for theophylline and paracetamol over a 9-day interval. The values obtained indicated an anomalous transport mechanism for both model drugs.

ETHANOL-WATER FRACTIONATION OF SUGAR CANE BAGASSE CATALYZED WITH ACIDS

CRISTINA M. AREA, FERNANDO E. FELISSIA* and MARIA E. VALLEJOS

*Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET),
Programa de Investigación de Celulosa y Papel, Facultad de Ciencias Exactas, Químicas y
Naturales, Universidad Nacional de Misiones, Felix de Azara 1552 (3300) Posadas,
Misiones, Argentina*

**Programa de Investigación de Celulosa y Papel, Facultad de Ciencias Exactas, Químicas
y Naturales, Universidad Nacional de Misiones, Felix de Azara 1552 (3300) Posadas,
Misiones, Argentina*

The conditions for maximizing bagasse ethanol-water fractionation (in cellulose, hemicelluloses and lignin) were established by the evaluation of different variables (time, temperature, catalyst). To this end, the organic compounds of the fibrous material and liquors were quantified. Acetic (2 g/L) and sulfuric (0.5, 1.0 and 2.0 g/L) acids were used as catalysts. An alkaline extraction was applied as a pre-treatment, using 3.6 g/L NaOH, at 100 °C, for 1 h. The effects of different conditions of the organosolv treatment on the kinetics, composition of the fibrous material and residual liquor, upon the fractionation of sugar cane bagasse used in this work, were investigated. The kinetic parameters were determined for delignification under six different conditions. The organic compounds of the fibrous material were quantified and lignin (by UV-visible spectroscopy) and carbohydrates, organic acids, furfural and HMF (by HPLC chromatography) were evaluated in residual liquors. The incorporation of sulfuric acid at 160 °C produced delignification degrees similar to those obtained by the addition of acetic acid at 180 °C, or in the fractionation without catalyst (85-86%). The delignification values showed that fractionations could be stopped at 90 or 120 min, since, after 90 min, the delignification percentage decreases by only about 1%. The incorporation of sulfuric acid extracted a large amount of xylose and produced further degradation of cellulose. Fractionations with acetic acid did not differ largely from the auto-catalyzed ones.

CHEMICAL MODIFICATION AND CHARACTERIZATION OF STRAW LIGNIN

ELENA UNGUREANU, OVIDIU UNGUREANU*, ADINA-MIRELA CĂPRARU and VALENTIN I. POPA

“Gheorghe Asachi” Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection, 71, Bvd. Mangeron, 700050 Iasi, Romania
**“Ion Ionescu de la Brad” University of Agricultural Sciences and Veterinary Medicine, 3, M. Sadoveanu Alley, 70049 Iasi, Romania*

This work aims at describing the modification and characterization of lignin separated from annual plants (wheat straw) by their delignification through the alkaline method. The lignin has been subjected to the hydroxymethylation reaction, for introducing hydroxyl groups into its structure, thus assuring a more complete exploitation of this natural aromatic polymer. Chemical and spectral analyses (FTIR, UV-VIS, fluorescence, HPLC), and thermal stability characterization (TG, DTG) have been carried out to evidence the transformations occurring in the lignin macromolecule. The experimental data show that the hydroxymethylation reaction induces the modification of lignin functionality and polymolecularity. Further, the properties of modified lignin were demonstrated in experiments on wood bioprotection.

INFLUENCE OF COOKING CONDITIONS ON THE PROPERTIES OF FIRST-THINNING SCOTS PINE (*Pinus sylvestris*) KRAFT PULP

RIIKA RAUTIAINEN and RAIMO ALÉN

University of Jyväskylä, Department of Chemistry, Laboratory of Applied Chemistry, P.O. Box 35, FI-40014 Finland

Kraft pulping of first-thinning Scots pine (*Pinus sylvestris*) was investigated under varying conditions to clarify the simple relationships between the principal cooking parameters (active alkali, sulfidity and cooking time) and the basic pulp properties (yield and kappa number). It was found out that, regardless of sulfidity (25 or 40%), an increase in the active alkali (25 → 30% on wood as NaOH) resulted – for the same cooking time – in a more effective removal of lignin (of about 10%), but also in a pronounced yield loss (4-6%). On the other hand, when aiming at the same target kappa number (of about 25), the cooking time at the maximum temperature (170 °C) could be decreased by about 35%, at the same active alkali increase.

ETHANOL AND SODA PULPING OF TAGASASTE WOOD: NEURAL FUZZY MODELING

ASCENSIÓN ALFARO, ANTONIO PÉREZ,^{*} JUAN C. GARCÍA,^{*}
FRANCISCO LÓPEZ,^{*} MINERVA A. M. ZAMUDIO^{*} and ALEJANDRO
RODRÍGUEZ^{**}

Department of Agroforestry Sciences, Faculty of Experimental Sciences, University of Huelva, Huelva, Spain

^{}Department of Chemical Engineering, University of Huelva, Huelva, Spain*

*^{**}Department of Chemical Engineering, Campus of Rabanales, C-3,
University of Córdoba, Córdoba, Spain*

A central composite experimental design, in conjunction with the ANFIS Edit Matlab 6.5 software (to develop a neural fuzzy model), was used in the study of the influence of ethanol and alkaline soda pulp process variables on the properties of pulps and paper sheets obtained from tagasaste (*Chamaecytisus proliferus* L.F. ssp *palmensis*) trimming residues. A variation range, involving three independent variables at three different (variation) levels, was established for each process variable (*viz.* temperature, cooking time and soda or ethanol concentration). The obtained models reproduced the experimental results of the dependent variables with errors below 8%. Under optimum experimental conditions, the yield of the ethanol process is 4% higher than that of the soda process. On the other hand, soda pulp has a higher α -cellulose content and a lower lignin content than ethanol pulp. The optimum conditions for the soda process involve a temperature of 180 °C, a cooking time of 60 min and an active alkali concentration of 16%, while those of the ethanol process are: 185 °C, 90 min and a 60% v/v ethanol concentration. The results obtained recommend the tagasaste trimmings as an effective raw material for obtaining paper pulp by ethanol and alkaline soda pulp processes.

DELIGNIFICATION OF ALEPPO PINE WOOD (*Pinus halepensis* Mill) BY SODA-ANTHRAQUINONE PROCESS: PULP AND PAPER CHARACTERISTICS

AHMED HADDAD, DOMINIQUE LACHENAL,* ALAIN
MARECHAL,*
GÉRARD JANIN** and MOHAMED LABIOD

Forestry Department, Faculty of Sciences, Tlemcen University, Algeria
**LGP2-PAGORA, 461, Rue de la Papeterie, BP65, 38402 St. Martin d'Hères, France*
*** CRF-INRA, 54280 Champenoux, France*

Aleppo pine, the dominant species of the Algerian forest, grows in sufficient quantity to satisfy its various industrial applications. Papermaking is a possible way for the valorization of the wood products resulting from thinning operations or short rotation logging. The present study observes the delignification of aleppo pine (*Pinus halepensis* Mill) young wood by an alkaline process (soda-anthraquinone), which allows the preparation of a chemical pulp from this type of wood (small wood). The physico-chemical and morphological analysis of the pulp is carried out, along with the study of delignification, to better understand the reactivity of wood in alkaline cooking. The kinetics of delignification shows that a total cooking time of 135 min makes it possible to exceed the defibring point by giving a yield bordering 44% with a kappa number of 29. It is obvious that the results obtained encourage the use of aleppo pine young wood as a raw material for the Algerian paper industry.

MODELLING OF DISPLACEMENT WASHING OF PULP: COMPARISON BETWEEN MODEL AND EXPERIMENTAL DATA

SHELLY ARORA and FRANTIŠEK POTŮČEK*

Department of Mathematics, Punjabi University, Patiala – 147002 (Punjab), India
**Institute of Chemistry and Technology of Macromolecular Materials,*
Faculty of Chemical Technology, University of Pardubice, 532 10 Pardubice, Czech Republic

A mathematical model assuming an axial dispersion mechanism, based on two dimensionless criteria, namely the Peclet number and the Biot number, was proposed for the displacement washing of a packed bed of porous, compressible and cylindrical particles. Bulk fluid concentration, intrapore solute concentration and concentration of the solute adsorbed onto the fiber surface were considered as a function of both washing time and position in the bed. Displacement washing experiments performed on pulp beds formed of unbeaten, unbleached kraft fibers were simulated with a laboratory washing cell. The model predicted values of the breakthrough curves, and the average alkali lignin concentration in the bed and displacement ratio were compared with those obtained experimentally. A close agreement was found between the experimental data and the ones calculated from model equations.

COMPARATIVE KINETIC ANALYSIS OF A LACCASE-MEDIATOR SYSTEM TREATMENT OF PULP AFTER OXYGEN DELIGNIFICATION AND CHLORINE DIOXIDE BLEACHING

G. RADEVA, I. VALCHEV and E. VALCHEVA

University of Chemical Technology and Metallurgy, 1756 Sofia, Bulgaria

The effect of Novozyme AS laccase and of the 1-hydroxybenzotriazole mediator on unbleached and oxygen delignified kraft pulp is studied. The kinetic investigations, based on the relatively decreasing kappa number and light adsorption coefficient, show that an exponential kinetic equation valid for processes taking place on uniformly inhomogeneous surfaces can explain the action of the laccase-mediator system (LMS). The activation energy found remains constant during the bleaching processes, while the preexponential factor changes, thus determining the current rate decrease. The correlations derived between the kinetic characteristics depend neither on temperature nor on the reaction time. The investigations carried out indicate that delignification becomes the prevailing process in the LMS treatment, followed by chlorine dioxide bleaching. The process leading to the chromophoric decrease starts to dominate the complex process when the LMS treatment is followed by oxygen delignification.

SUBSTITUTION OF SODIUM HYDROXIDE WITH MAGNESIUM HYDROXIDE AS AN ALKALI SOURCE IN THE PEROXIDE BLEACHING OF SOFTWOOD TMP

HUIREN HU and HONGJIE ZHANG*

Tianjin Key Laboratory of Pulp and Paper, Tianjin University of Science and Technology, Tianjin, 300457, China

**Key Laboratory of Cellulose and Lignocellulosics Chemistry, Guangzhou Institute of Chemistry, Chinese Academy of Sciences, Guangzhou, 510650, China*

Softwood thermo-mechanical pulp (TMP) was subjected to peroxide bleaching, by substituting sodium hydroxide (NaOH) with magnesium hydroxide ($Mg(OH)_2$) as an alkali source. The optical and physical properties of the bleached pulps were compared, as well as the COD, anionic trash and the organic and inorganic compounds present in the bleaching effluent. The results showed that, at the same hydrogen peroxide charge, the bulk opacity of $Mg(OH)_2$ -based bleached pulp increased obviously, while the amount of anionic trash and COD in the bleaching effluent decreased significantly, compared with that observed during NaOH-based bleaching. Furthermore, the consumption of hydrogen peroxide decreased considerably during $Mg(OH)_2$ -based TMP bleaching. However, the physical properties and brightness gain resulted from the $Mg(OH)_2$ -based process were comparable to or just slightly lower than those obtained by the NaOH-based one.

THE SUPERIORITY OF HYDRATED ZINC AND NICKEL VERSUS HYDRATED SODIUM SULFATE IN THE FLAME-RETARDANCY OF CELLULOSIC FABRICS

S. M. MOSTASHARI, O. BAGHI and H. F. MOAFI

Faculty of Science, University of Gilan P. O. Box 1914, Rasht, Iran

Some hydrated sulfates, namely $ZnSO_4$, $NiSO_4$ and Na_2SO_4 , have been selected and deposited onto cotton fabrics, for investigating their effectiveness as flame-retardants. A vertical flame spread test was then accomplished and the specimens' degree of resistance to burning was assessed. An efficient quantity of $ZnSO_4$, expressed in dry salt per 100 g fabric, has been determined over the 11.2-16.3 g range. For $NiSO_4$, this value was obtained over the 11.8-14.3 g range. In spite of this close resemblance, the incorporation of Na_2SO_4 over about 25.2% (almost twice as much as the above-mentioned quantities) showed no trace of flame-retardancy. Thermogravimetric analyses of both pure cotton and cotton treated with the afore-mentioned salts were accomplished, the thermograms being compared and interpreted. The results obtained for zinc and nickel sulfate suggest that the expulsion of the hydration water present in treated cellulose occurred well below the desirable range, prior to the thermal degradation of the cotton substrate. However, the application of sodium sulfate decahydrate to the cotton fabric illustrated an overlapped curve in the cellulose thermogram. Quite significantly, the loss of hydration water for the last mentioned salt occurred approximately in the same temperature zone of the thermal decomposition range of the polymer, where it showed no advantage in imparting flame-retardancy. Meanwhile, the thermograms for hydrated $ZnSO_4$ and $NiSO_4$ showed mass loss at high temperature, below the above-mentioned zone, which involves the catalyzation of the substrate thermal degradation; hence, their combustion retardation can be controlled.

PRE-TREATMENT OF OIL PALM BIOMASS FOR ALKALINE PEROXIDE PULPING

A. GHAZALI, W. D. WAN ROSLI and K. N. LAW*

University Sains Malaysia, 11800 USM, Penang, Malaysia

**University of Québec in Trois-Rivières, P. O. Box 500, Trois-Rivières, Québec, Canada
G9A 5H7*

Oil palm biomass in the form of an empty fruit bunch (EFB) was examined for defining the extent of pre-treatment required by the biomass before an alkaline peroxide pulping process. Minerals such as silica and the derivatives of transition metals were identified as problematic to the pulping process. Specifically for silica removal, initially, hammering and pressing appeared as two powerful processes while, for transition metals, chelation with diethylenediaminepentaacetic acid (DTPA) was performed. The results obtained show that a complete treatment removed calcium, copper, manganese and sodium by 50, 100, 95 and 93%, respectively, while a total of 86% of silica bodies were also identified as removable. From these figures, the removal of 54% of the silica bodies was determined by the mechanical treatment, while 10% was attributable to the effect of DTPA. Since silica is inert towards DTPA, it is plausible that silica was closely associated to other minerals. The removal of the minerals by chelation with DTPA, therefore, reduced the attachment of the silica bodies to the biomass matrix, resulting in the liberation of silica. The procedure studied allowed a milder pulping process, eliminating the need for screw pressing, in the case of alkaline peroxide pulping. The use of DTPA during pulping can be also eliminated.

CONTRIBUTION TO THE HISTORICAL DEVELOPMENT OF MACROMOLECULAR CHEMISTRY – EXEMPLIFIED ON CELLULOSE

PETER ZUGENMAIER

*Institute of Physical Chemistry, Clausthal University of Technology, D-38678 Clausthal-
Zellerfeld, Germany*

The development of the structure determination for cellulose and its derivatives as macromolecules is described from the beginning of the 20th century to the 1940s. The first correct presentation of the constitution of cellulose as a linear chain macromolecule of 1-4 linked β -D-anhydroglucopyranose, with the help of organic chemistry, dates from 1928. The size and shape of cellulose molecules still remained a controversial topic for some time. On the one hand, there were proposals of micelles *i.e.* aggregates of cyclic mono- or oligoanhydroglucose or micelles of small macromolecules of 30-50 glucose units. On the other hand, cellulose was seen as large macromolecules with more than 3000 glucose units for structures considered in solution as well as in fibres. The final clarification of the cellulose structure as a semi-flexible macromolecule of high molecular weight was extremely hindered by the inadequate interpretation of experimental results. Later, additional experimental and theoretical methods led to a consistent picture of the cellulose structure with high precision.

ACCESSIBILITY AND SUPERMOLECULAR STRUCTURE OF CELLULOSE

MICHAEL IOELOVICH and ALEX LEYKIN

Polymate Ltd, Migdal HaEmek, 23100, Israel

The accessibility of cellulose samples with various crystallinity degrees to molecules of water, lower primary alcohols and lower organic acids was studied. It was found out that small water molecules have full access to the non-crystalline domains of cellulose (accessibility coefficient $\alpha = 1$). The molecules of the lowest polar organic liquids have partial access to these domains ($\alpha < 1$), while, with an increasing diameter of the organic molecules, their access to the cellulose structure decreases. The accessibility of cellulose samples to molecules of various substances is a linear function of coefficient α and of the content of non-crystalline domains. The relationship between the crystallinity (X) and accessibility (A) of cellulose to the molecules of some liquids was established as $A = \alpha (1-X)$. The water molecules were found to have greater access to the cellulose samples than the molecules of the investigated organic liquids. The obtained results permit the use of accessibility coefficient values to estimate cellulose crystallinity, to examine the structural state of the non-crystalline domains and to predict the reactivity of cellulose samples towards some reagents.

INFLUENCE OF OXIDATION ON INTRINSIC FIBER STRENGTH

PU MA, KWEI-NAM LAW* and CLAUDE DANEALU*

Jiangsu Provincial Key Laboratory of Pulp and Paper Science and Technology, Nanjing Forestry University, Nanjing 210037, China

**Centre Intégré en Pâtes et Papiers, Université du Québec à Trois-Rivières, G9A 5H7, Canada*

The creation of carboxylic acid groups on fibers to improve the inter-fiber bonding potential by means of 4-acetamido TEMPO-mediated oxidation could influence intrinsic fiber strength. The effect of the conditions of such an oxidative process on the fiber strength of mechanical pulp fibers was examined. It was found out that the alkalinity and dose of NaBr had a particularly significant influence on intrinsic fiber strength, as measured by the zero-span tensile strength of the dry handsheets.

PREPARATION OF CELLULOSE/CHITIN BLEND BIO-FIBERS VIA DIRECT DISSOLUTION

SHUAI ZHANG, FA-XUE LI* and JIAN-YONG YU**

*Key Laboratory of Textile Science Technology, Ministry of Education,
Shanghai 201620, China*

**College of Textiles, Donghua University, Shanghai 201620, China*

***Modern Textile Institute, Donghua University, Shanghai 200051, China*

The paper proposes a novel way for preparing cellulose/chitin blend fibers from a NaOH/thiourea/urea aqueous solution by direct dissolution. The structure, miscibility and properties of the blend fibers were investigated in detail. It was demonstrated that cellulose and chitin showed a good miscibility in blend fibers. The thermal stability of the blend fibers was higher than that of pure cellulose fibers, due to the strong interaction between the cellulose and chitin molecules. However, the blend fibers displayed slightly lower tensile properties than those of pure regenerated cellulose fibers, which was attributed to the partial damage of the cellulose crystalline region, caused by chitin addition. Additionally, SEM measurements evidenced a rather smooth and homogeneous morphology of the blend fibers.

CHARACTERIZATION OF NON-WOOD LIGNIN AND ITS HYDOXYMETHYLATED DERIVATIVES BY SPECTROSCOPY AND SELF-ASSEMBLING INVESTIGATIONS

TATIANA TODORCIUC^a, ADINA-MIRELA CĂPRARU^a, IRENA KRATOCHVÍLOVÁ^b and VALENTIN I. POPA^a

^a“Gheorghe Asachi” Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection, 71, Mangeron Bvd., 700050 Iasi, Romania

^bInstitute of Physics, ASCR, v.v.i., Na Slovance 2, CZ-182 21 Prague, Czech Republic

Two types of non-wood lignins, namely wheat straw lignin (L1) and Sarkanda grass lignin (L2) (offered by Granit Recherche Développement S.A., Lausanne) were characterized, together with their hydroxymethylated derivatives. To this end, the afore-mentioned lignins have been subjected to hydroxymethylation, under optimal conditions of temperature, time and pH. The unmodified and the hydroxymethylated lignins were analyzed by spectroscopic methods (FTIR, UV-VIS and fluorescence spectroscopy), and atomic force microscopy (AFM). The results point out that the reactivity level of lignin depends on its origin and structure of lignin, while the characteristics of the synthesized products result from the modifications induced by the new functional groups.

CONTRIBUTION TO THE MODIFICATION AND CHARACTERIZATION OF DIFFERENT TYPES OF LIGNINS

ADINA-MIRELA CĂPRARU, VALENTIN I. POPA, TEODOR MĂLUȚAN and GABRIELA LISĂ

“Gheorghe Asachi” Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection, 71, Mangeron Blvd., 700050 Iasi, Romania

The paper presents the results obtained in the modification and characterization of residual lignins separated from the alkaline delignification of annual plants (Sarkanda grass and wheat straw), along with some commercial products (Protobind), offered by Granit Recherche Développement S.A., Lausanne, Switzerland. To this end, the lignins were subjected to a hydroxymethylation reaction under different temperature and pH conditions and then characterized by spectroscopy (FTIR, UV-VIS and fluorescence), as well as from the viewpoint of their thermal stability. The obtained data point out that the reactivity of lignins depends on the source, while the properties of the synthesized derivatives are consistent with the changes induced in their functionality.

ORGANOSOLV PULPING OF COTTON LINTERS

NAHED A. ABD EL-GHANY

Department of Chemistry, Faculty of Science, Cairo University, Egypt

Compared to prehydrolysis soda pulping, prehydrolysis soda ethanol pulping of cotton linters stabilizes the long-chain cellulose macromolecules against alkaline degradation. The presence of ethanol also results in a more open and accessible fine structure, higher chemical reactivity (in xanthation), and better viscose filterability. Prehydrolysis soda ethanol anthraquinone pulping results in a still higher stabilization of cellulose in cotton, a more open and accessible fine structure, higher chemical reactivity and a better viscose filterability. In this respect, the hydrochloric acid (HCl) is superior to the sulphuric acid (H₂SO₄). The prehydrolysis soda ethanol anthraquinone pulping method gives cotton linters with better chemical reactivity than that of commercial softwood pulp.

INFLUENCE OF GALL INK COMPOSITION ON THERMAL STABILITY OF PAPER

MARTA URSESCU, GABRIELA LISĂ,* CORINA MĂLUȚAN* and
SORIN CIOVICĂ*

*Cultural Heritage Restoration-Conservation Centre, "Moldova" National Complex
of Museums, 700028 Iasi, Romania*

**"Gheorghe Asachi" Technical University of Iasi, Faculty of Chemical
Engineering, P.O. Box 10, 71 A, Bd. D. Mangeron, 700050 Iasi, Romania*

The study evidences the effects of gall ink ingredients on the thermal stability of paper by thermogravimetry and differential thermal analysis. Paper samples treated with different gall inks, as well as untreated paper and powdered Arabic gum, were subjected to thermal ageing. The thermal degradation of the samples was examined both before and after accelerated ageing, and the results obtained confirmed the variation of the parameters assessing the thermal stability of paper.

AROMATHERAPEUTIC CHARACTERISTICS OF COTTON FABRICS TREATED WITH ROSEMARY ESSENTIAL OIL

A. MURESAN, ANGELA CEREMPEI, SIMONA DUNCA*,
RODICA MURESAN and R. BUTNARU

*"Gheorghe Asachi" Technical University, Faculty of Textiles, Leather and Industrial
Management, Iasi, Romania*

**"Alexandru Ioan Cuza" University, Faculty of Biology, Iasi, Romania*

The paper targets the production of textile fabrics with aromatic and antimicrobial properties by applying a chitosan film containing rosemary essential oil, at the surface level. The release in time of the essential rosemary oil was confirmed by colour and odour qualitative tests. The mechanical and comfort indices were also determined (rigidity, hydrophilic and hygroscopic characteristics), as well as the antibacterial properties.

Another objective of the paper is to establish the kinetic model for the controlled release of the essential oil mechanism.

APPLICATION OF A LOW-LEVEL, UNIFORM ULTRASOUND FIELD FOR THE ACCELERATION OF ENZYMATIC BIO-PROCESSING OF COTTON

BRIAN CONDON, MICHAEL EASSON, VAL YACHMENEV, ALLAN
LAMBERT,
CHRIS DELHOM and JADE SMITH

Southern Regional Research Center, 1100 Robert E. Lee Blvd, New Orleans, LA 70124, US

Enzymatic bio-processing of cotton generates significantly less hazardous, readily biodegradable wastewater effluents, yet having several critical shortcomings, such as expensive processing costs and slow reaction rates, which impedes its acceptance at an industrial level. Our research showed that the introduction of a low-energy, uniform ultrasound field in enzyme-processing solutions greatly improved enzyme efficiency by significantly increasing their reaction rate. It has been established that the following specific features of combined enzyme/ultrasound bio-processing of cotton are critically important: a) the cavitation effects caused by the introduction of an ultrasound field in the enzyme processing solution greatly enhance the transport of enzyme macromolecules towards the substrate surface, b) the mechanical impact, produced by the collapse of the cavitation bubbles, provides an important benefit, that of “opening up” the surface of the solid substrates to the action of enzymes, c) the effect of cavitation is several hundred times higher in heterogeneous (solid substrate-liquid) than in homogeneous systems, and d) in water, the maximum effects of cavitation occur at ~50 °C, which is the optimum temperature for many industrial enzymes. At a laboratory scale, the introduction of ultrasonic energy in the reaction chamber during enzymatic bio-preparation of greige cotton fabrics and enzymatic bio-conversion of cotton gin and cotton lint waste biomass in sugars resulted in a significant improvement in enzyme efficiency.

THERMOGRAVIMETRY OF DEPOSITED AMMONIUM ALUMINUM SULFATE DODECAHYDRATE USED AS FLAME-RETARDANT FOR COTTON FABRICS

S. M. MOSTASHARI and S. Z. MOSTASHARI

Faculty of Science, University of Gilan, Rasht, Iran

The effect of ammonium aluminum sulfate dodecahydrate on the flammability of 100% cotton fabric (woven with a density of 144 g/m²) has been studied. The laundered, total dried, weighed fabrics were impregnated with a suitable concentration of aqueous ammonium aluminum sulfate dodecahydrate solutions by squeeze rolling and dried at 110 °C for 30 min. They were then cooled in a desiccator, re-weighed with analytical precision and kept under ordinary conditions overnight, prior to the fulfillment of the vertical flame test, applied for determining the specimen's resistance to burning and flame spreading. The optimum add-on value of the salt to impart flame-retardancy to a cotton fabric ranged between 9.82 and 12.16 g anhydrous salt per 100 g fabric. Furthermore, thermogravimetry of both pure cotton and cotton treated with the above-mentioned additive, as well as of pure salt, was accomplished and their TG/DTG curves were compared and commented. The results obtained agree with the Dust or Wall Effect Theory, and with the Gas Dilution Theory.

CONFERENCES, SYMPOSIA***PTS Paper Symposium*****Munich, September 7 – 10, 2010**

PTS invites to this year's **Paper Symposium** - at the same venue (directly adjacent to the Oktoberfest in Munich) but one week earlier than usual and with a particularly attractive lecture programme. Being an important international meeting point for the industry, the **Paper Symposium** will also offer an attractive supporting programme for discussions and exchanges.

The first conference day addresses, among other, the industry's senior management, shedding light on the economic future of our value chain. The keynote speech about "*Ethics in business*" delivered by professor Claus Hipp, the well-known entrepreneur, baby food producer, artist and social ethicist, will be our first highlight.

The afternoon session focuses on "*New products on established machines*". Paper producers and their customers will have a closer look at this issue.

Trendsetting research activities, new products and technologies must be geared towards economic needs to be formulated as political aims. How can we contribute to these processes and which results are possible? These and other questions will be answered by competent speakers and senior experts.

The two following days present brand-new technological developments. Headlines

include "*sustainability*", "*quality*", "*fillers*", "*fibres*", "*deposits*", "*energy*", "*processes*" and "*machinery*". The results of application-oriented research and development activities reveal opportunities to improve the sustainability and efficiency of paper mills.

A new element complementing the lectures will be posters presenting important research activities of institutes and universities. Companies can use this option as well to show their latest developments in a concise form. Applications are still welcome.

„I never see what has been done; I only see what remains to be done.“ (Marie Curie) - In this spirit, PTS is looking forward to welcoming a high number of active attendees. To learn about the latest strategies and technologies. And to jointly discuss what remains to be done. For further details, please visit our homepage www.paper-symposium.com.

Press contact:

*Papiertechnische Stiftung
Erwin Polmann
Hess-Strasse 134
80797 München
Tel: +49-89-12146-230*

E-Mail: erwin.polmann@ptspaper.de